UBA Annual Report 2000

Annual Report 2000

Umwelt Bundes Amt

For Humanity and Environment

Published by:
Umweltbundesamt
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Designed and printed by:
KOMAG GmbH, Berlin

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Foreword

The time has come: since 2000 the Federal Environmental Agency (UBA) has been present at its new location in Dessau (Saxony-Anhalt). In some respects, the exhibition on the new building project that was held in conjunction with the World Exhibition EXPO 2000, attracting some 3,500 visitors to Dessau, was a good sign. Since 6 October 2000, Vice-President Dr. Kurt Schmidt has taken up his work in the restored Wörlitz railway station. The new building, which is located on the same premises, was built according to the design by the renowned architects sha sauerbruch hutton. It is intended to serve as both an ecological model and an attractive sight. Furthermore, the building has been designed in such a manner that each room and workplace can be easily reached and used by handicapped people.

Whether from Berlin or from Dessau – and not to be forgotten, the measuring stations of the air measuring network as well as our branches in Bad Elster and Langen: the UBA is not only dedicated to environmental protection in Germany, but also on an international scale. Whether the contamination of waters, soil or air with pollutants or burdens for man and the environment by long-life environmental chemicals – not to mention the further increase in traffic: the effects are usually not restricted to the countries in which they are generated. On the other hand, no country is capable of solving its environmental problems by itself.

Today's environmental problems are also less perceivable than they were in the 1960s and 1970s – at least here in Germany. Highly crucial problems can often only be recognized by sober figures, or using models that do not directly address our senses. The Sixth Session of the UNFCCC Conference of the Parties on the Kyoto Climate Protocol, that was held in November 2000 in The Hague and ended without a result, is a clear example that the road from identifying and naming a problem to concrete action is a long and difficult one. It is urgently hoped that the continuation of these talks in July 2001 in Bonn will reach a successful conclusion.

UBA Annual Report 2000
Foreword

Consumer protection is now the talk of the town since the occurrence of the so-called mad-cow disease and the spreading of foot and mouth disease, after the insights into the misuse of medicines in livestock fattening and other "scandals" in food production. The UBA has always considered consumer interests to be an important point of reference for its work, after all, without intact, natural foundations for life, there can be no safe food and consumables. This applies particularly to the supply of hygienically pure drinking water. The most famous symbol for ecologically recommended products of every day life is certainly the "Blue Angel", the German eco-label. The number of product groups that have been given this label grew once again this year.

In recent years, the Federal Environmental Agency has supported and technically accompanied the "EU Eco Audit System (EMAS)". The aim was to provide support for EMAS users in the commercial sector implementing this European ordinance. The UBA has also adopted the standards for itself which it recommends to others: for example, we have ensured that both the requirements of the EMAS ordinance as well as the DIN ISO 14001 international environmental management standard is implemented with determination at our premises at Bismarckplatz.

Up to now, EMAS was restricted to just a few certain industries. This is soon to change when the new, extended EMAS ordinance officially comes into effect in Germany. This is when the UBA will also display transparency in internal environmental protection, presenting its environmental declaration to the public and becoming the first German Federal authority entitled to bear the new EMAS logo.

The UBA Annual Report traditionally supplies a host of facts, trends and contexts – whilst at the same time attempting to remain understandable for the general public. You can decide whether we have succeeded here – please send us any suggestions that you may have and do not hesitate if you have something to criticise. A host of other information – continuously updated – is also available on the Internet at: www.umweltbundesamt.de.

More tasks, more services with staff numbers continuing to decline: this is all only possible because our employees are dedicated far beyond what is required of them, finding much national and international recognition for their technical proposals and thus receiving much satisfaction and acknowledgment. I would like to thank all the colleagues at the Agency, after all, *you* are the Federal Environmental Agency.

Prof. Dr. Andreas Troge
President

Portrait: The Federal Environmental Agency on the move

Overview

- On the way to Dessau
- Who we are – what we do
- Organization development
- Personnel development
- Environmental management – a pioneering role

On the way to Dessau

The year 2000 was a particularly special year for the Federal Environmental Agency (UBA): the Agency has set two clear signals at its future location in Dessau. For example, the exhibition on the new building project attracted 3,500 visitors. Finally in October, the State Civil Engineering Office in Dessau handed over the Wörlitz railway station to the UBA. This train station has since housed the Agency's first office building in Dessau, the seat of the Vice-President with the Build-up Staff Dessau. The restoration work that began on this historical Wörlitz railway station at the end of 1999 was completed after just nine months of construction. At the same time, the requirements for a listed building were taken into consideration to the same extent as the state-of-the-art requirements for thermal insulation. Page 182 covers these special events in detail. *(ASDE)*

Who we are – what we do

The Federal Environmental Agency (UBA) was set up by law on 22 July 1974 as an independent supreme Federal authority. In 2004 the UBA is to move from Berlin to Dessau. The UBA is responsible for the following tasks:

- To provide scientific support to the Federal Ministry for the Environment (BMU) in the fields of immission and soil protection, waste and water

The Federal Environmental Agency in Berlin-Grunewald, Bismarckplatz 1 (Main building). (Photo: UBA/Hagbeck)

management and with regard to health issues in environmental protection. This applies in particular to the preparation of legal and administrative regulations.
- To research and develop foundations for suitable measures and to test and examine methods and equipment.
- To set up and manage an information system for environmental planning as well as a central environmental archive; to measure large-scale air pollution; to inform the public on environmental issues.
- To provide central services and assistance for department research and co-ordination of environmental research by the Federal Government and to support the Federal Government when examining the environmental compatibility of measures.

In order to fulfil these tasks, the UBA also carries out its own scientific research. The UBA is also responsible for a further series of functions (see box on page 9). In order to meet with Germany's international obligations, the Agency is represented in 320 committees, 62 of which are located in the United Nations (UN) and 29 in the Organization for Economic Co-operation and Development (OECD). The UBA also has staff working with the European Union (EU) in a total of 105 committees (refer to detailed information contained in chapter 1).

This kind of cross-sectional orientation depends heavily on a wide range of contacts with various institutes. This is why the UBA has staff in various committees, for example, the Institut für Umweltmanagement [Institute for Environmental Management], the Umweltforschungszentrum Leipzig [Environmental Research Centre, Leipzig] and the Advisory Board of the "Umwelt" magazine from the VDI publishing house. This also involves meetings with associations, including, for example, the Verband der deutschen Automobilindustrie (VDA) [German automobile industry association], the Bundesverband Deutscher Entsorger (BDE) [Federal association of German waste companies] and the Naturschutzbund Deutschland (NABU) [German nature conservation association]. Exchanging experience with members of parliament is just as much part of our work as joint research initiatives with other research institutes and promotion societies, such as the German Federal Foundation for the Environment (DBU), the Federal Ministry of Education and Research (BMBF) and the German Research Community (DFG). The Agency's scientists are actively involved in lecture and discussion events held by educational institutions and political foundations, such as the Heinrich-Böll-Stiftung [Heinrich Böll Foundation] or the Evangelische Akademie Tutzing. The UBA also co-operates with various other parties, for example, with the Gesellschaft für Technische Zusammenarbeit (GTZ) [Society for Technical Co-operation] and German Federal Ministry of Economics and Technology (BMWi) in the field of technology transfer.

Within the scope of management-level talks with other authorities – including the Federal Statistical Office (StBA), the Federal Biological Research Centre for Agriculture and Forestry (BBA) and the Federal Institute for Geosciences and Natural Resources (BGR) – or with associations – including the Bund für Umwelt und Naturschutz Deutschland (BUND) [Association for environmental protection and nature conservation in Germany], the World Wide Fund for Nature (WWF), Greenpeace, the Federal Association of German Industry (BDI) and the Association of Chemical Industry (VCI) – the UBA regularly discusses various technical issues and interests. What's more, co-operation projects are agreed to and initiatives are triggered.

Contacts are an important aspect in all the task fields of the UBA, enabling the Agency to perform its tasks – whether in the form of information exchange, expert discussions or co-operation.

In this context and in view of the discussion on sustainability (refer to chapter 3), co-operation is becoming increasingly important where all the parties involved can discuss their different positions and perspectives and, based on this, co-ordinate common goals. In order to be able to represent the interests of environmental protection in such processes and to provide "ecologically sound" orientation during the development of action aims, the UBA has taken an active role in the initiation and organization of such campaigns. This is the case, for example, with the dialogue on Environment and Work, the Chemical Dialogue on Sustainability and the Stakeholder Meeting, i.e. the meeting of interest groups. *(I 1.1)*

Organization development

In 1999, the UBA reorganized itself (refer to the 1999 Annual Report). The aims of this measure were:

- to streamline the Organization and procedures,
- to establish stable Organizational units,
- to integrate the Institut für Wasser-, Boden- und Lufthygiene (WaBoLu) into the work contexts and working environment of the UBA,
- to make use of synergetic effects and
- to exhaust rationalisation effects, including personnel capacities.

In order to examine to what extent the aims described have been reached, the new Organization underwent quality assurance. For this purpose, reporting officers were appointed for the various task areas with the task of informing executive management of the experience gained with the Organizational changes. It became clear that the main components of the new Organization have stood the test. In some areas, plans exist to develop the Organization further.

This means that it will be necessary to reduce the Organization further in terms of the number of units or sections and departments.

In the field of Organization, a comprehensive task review was carried out once again. The first steps for the introduction of electronic process handling have been introduced by a call for tenders for a UBAsibility study. Another important step towards modernizing the UBA was the extensive delegation of signatory powers. This means that certain forms of correspondence no longer need to be submitted to executive management for signing; the staff responsible or their superiors have the authority to sign such correspondence themselves. An exchange of experience in September 2000 showed that this delegation of powers has contributed considerably to accelerating work procedures and to easing the workload for executive management.

It also boosts the responsibility borne by staff and hence work satisfaction and self-esteem.

In 2000, the UBA started a trail run for the introduction of telework for 15 employees in order to help reconcile family obligations and career aspirations.

On the way to Dessau: The restored historical Wörlitz railway station, seat of the Vice-President. Behind: The UBA building site. On the right: The future library seat. (Photo: UBA/Hagbeck)

Implementation and implementation-related tasks of the Federal Environmental Agency (a selection)

Environmental chemicals assessment office new substances, and assessment office for so-called existing substances under the *EU Directive on Existing Substances*

Involvement in the implementation of the *Plant Protection Act*, the *Genetic Engineering Act*, the *Leaded-Petrol Act*, the *Law on Medicines* and the *Law on Biocides* as a co-ordinating authority

Gathering and evaluation of information concerning washing powders and detergents pursuant to the *Law on Detergents and Cleaning Agents*

Approval authority for activities in the Antarctic region according to the *Law on the Implementation of the Environmental Protection Protocol* dated 4 October 1991 to the *Antarctic Treaty*

Co-operation in the implementation of the soil protection concept, the rehabilitation of historical pollutions and contaminated sites

Operation of the environmental specimen database and reporting on the results of analyses

"Environment and health" action programme, hosting the office of the co-ordination group, Environmental Survey

Management of the "Investment Programme for the Reduction of Environmental Burdens" together with Deutsche Ausgleichsbank (DtA)

Office "Storage and Transport of Substances Hazardous to Water"

Information and documentation office for substances hazardous to water

Contact office for matters related to the *Basle Convention*

Involvement in the awarding of the eco-label and promotion of environment-friendly products, particularly in public procurement processes

ZEMA Incident Notification Office

National reference laboratory for the EU for monitoring air pollution

Implementation of the *EU's Integrated Pollution Prevention and Control Directive (IPPC Directive)*

Implementation of the law against *Air Traffic Noise*

Office of the "Environmental Information Systems" work group of Federal and Federal-State Governments

Co-ordination office supporting the tasks of the joint central substance data pool of Federal and Federal-State Governments (GSBL)

Co-operation centre of the World Health Organization (WHO) for monitoring air quality and combating air pollution

Co-operation centre of the World Health Organization (WHO) for drinking-water hygiene

Performance of tests within the scope of Section 16 c of the *Federal Law on Epidemic Control*

Tasks in conjunction with the European Environment Agency (EEA)

German contact office (co-ordination of German participation)

German contact office for the fields of air quality, air emissions, inland waters, seas and coastal environment, soil and waste

European topic centre: air emissions

Tasks in conjunction with the preparation of EU membership for central and eastern European countries

Since the results of the trial run for both the staff and units involved are likely to be largely positive – pending a detailed evaluation of the results – telework will be expanded further in 2001.

On the whole, the information and discussions concerning the activities and elements of modernisation in the UBA itself and within the entire department of the Federal Ministry for the Environment are to be intensified. *(Z 1.3)*

Personnel development

Due to altered framework conditions, the task of personnel development is also becoming increasingly important in public administrations. This is why the optimised deployment of existing human resources is a crucial factor. This means that development opportunities must be used and a look must be taken into the future in order to identify as soon as possible how existing personnel and personnel requirements will develop for the different services of the Agency. We must be prepared for new alternatives for action and at the same time – despite certain problems resulting from cost-cutting measures – be able to recruit new, qualified staff for co-operation in the UBA. Important elements of the manpower development concept are as follows

- Personnel selection
- Personnel promotion measures (incentive systems, supporting up-and-coming young executives, assessment and promotion concepts)
- More flexible work Organization (telework, personnel exchanges)
- Management and co-operation (talks between staff und superiors, feedback for superiors, feedback talks, introduction of new staff)
- Training and further education
- Knowledge transfer.

In order to achieve this, the UBA is making use of a series of instruments that are already deeply rooted in the Agency. There are a number of activities that are allocated to personnel development and that have already been implemented with success. *(Z 1.1)*

Environmental management – a pioneering role

In 1999, the UBA decided to set up an environmental system on the basis of the EU Environmental Audit System ordinance (EMAS ordinance). In order to gather practical experience in a Federal authority with this system that was originally developed for producing industries, EMAS is to be initially introduced at the Agency's headquarters in Berlin only. The UBA has established an environmental committee headed by the Vice-President in order to co-ordinate and control this process. This committee includes the Agency's four divisions, the full-time industrial safety officer, the environmental officer and the staff council. The environmental officer is responsible for the practical implementation of the process. He is supported and assisted by an experienced consultancy company. Important progress was made in 2000:

- The "First Environmental Test" was completed, providing a comprehensive report on the causes and extent of all the environmental impacts that result from the Agency's operations. This marks the foundation stone for activating a systematic and continuous process of improving the UBA's internal environmental protection.
- In September, following intensive discussion, the Agency's executive management adopted the UBA environmental guidelines (see box on page 11). The environmental guidelines address the general aim of the Agency to soundly root environmental protection in the thoughts and actions of all and to derive from this the principles for internal environmental protection in the UBA.

Another important step is planned with the introduction of the actual environmental management system itself. This means that following the coming into force of the revised EMAS ordinance and examination by an independent environmental auditor, the UBA will be able to officially register in 2001 as an EMAS participant. *(I 2.2)*

Environmental guidelines of the Federal Environmental Agency

Preamble

In implementing the guiding policy of the Federal Environmental Agency, its employees are dedicated to:

- protecting and managing the natural basis for life,
- promoting sustainable development and
- rooting environmental protection as a matter of course in the thoughts and actions of all.

We are pursuing these aims, particularly in our Agency, and are persistently implementing what we recommend to others for promoting permanent, environmentally compatible development. This is why we apply an environmental management system, with our environmental guidelines serving as a foundation for this.

How we see ourselves

The Federal Environmental Agency contributes towards environmental protection, particularly through the execution of its technical tasks. We adhere to the applicable environmental protection regulations and are dedicated to the continuous improvement of environmental protection in conjunction with our work, setting ourselves concrete environmental objectives and regularly evaluating what has been achieved; whilst not forgetting to consider also the undesired environmental impacts of our products and services.

The Agency promotes awareness for the responsible and active dealings of all employees in the interest of environmental and health protection.

Reducing negative environmental impacts

We give preference to products that are most environmentally compatible in terms of their production, use and disposal.

We carefully use energy, water, materials and land, and we do so with a view to the environment.

We ensure that waste is avoided and unavoidable waste is recycled or disposed of in an environmentally compatible way.

Our business trips are carried out in the most environmentally compatible manner possible.

We involve our contract partners in our activities related to environmental and health protection.

Promoting transparency

We regularly perform environmental audits, publishing the results and the measures derived in an environmental declaration and hence inviting public discussion.

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Part 1

This year's key topics

1. At home in the world: the UBA's international and European tasks

Overview

- Introduction
- The European Union
- The United Nations – climate and biodiversity as examples
- International standardisation – construction products as an example
- The Organization for Economic Co-operation and Development – transport as an example
- The North Atlantic Treaty Organization (NATO)
- Co-operation with central and eastern Europe
- International marine protection
- Regional efforts – the Alps and the Baltic Sea area as examples
- Protection of the Antarctic region

Introduction

Environmental pollution is local, regional and global. Due to increasing global economic development, it is gaining a stronger international character. Environmental protection is a national and international task that is primarily the responsibility of the Federal Ministry for the Environment (BMU).

The Foreign Office (AA) supports international environmental policy, making its embassies and representations at international Organizations available. It is involved in negotiations and in the implementation of treaties for the protection of the environment and supports the export of German environmental technology through the global network of German foreign representations, particularly in developing and newly industrialised countries.

Since environmental pollution knows no borders and since we are all affected in the long term, co-operation with our partner countries is required. It is the task of the Federal Ministry for Economic Co-operation and Development (BMZ) to provide assistance for the social and ecological development of poorer countries particularly since the short and long-term costs for environmental disasters are much higher than the costs of their avoidance. Development policies must hence also include environmental policies.

The Federal Environmental Agency (UBA) helps the BMU (Federal Ministry for the Environment) to carry out its international environmental protection work. Almost all departments are involved and the international nature of the work is increasing continuously. 160 UBA employees are currently working in around 320 international committees, for example, at the European Union (EU), the United Nations (UN), the Organization for Economic Co-operation and Development (OECD) and the North Atlantic Treaty Organization (NATO). International standardization efforts have become extremely important. Other areas include the international protection of seas and waters and the European Council. Another issue is multilateral and bilateral co-operation.

The Agency also maintains bilateral contacts within the scope of the international visitor and guest programme (refer to Part 2, page 95). The UBA is also attractive for foreign partners because it can make its experience available for the implementation of legal requirements, setting up of environmental management systems, for environmental research and for access to environmental technology databases, whilst also naming experts on the diverse range of environmental topics. *(I 1.2)*

The European Union

Since environmental protection regulations are being increasingly drafted on a European level, UBA's staff are involved in a many EU committees working on environmental protection and health protection. The range of tasks is broad and includes the drafting of technical regulations and laws as well as the development of evaluation and testing methods for the implementation of legislative requirements. This also involves concepts on the reduction of environmental pollution, as well as environmental research and the

EU Eco-label. These activities will be described in more detail in the contributions by the individual departments in Part 2 (pages 93 and following).

The task of the European Environment Agency (EEA) is to provide the European Commission and the member states with up-to-date, targeted and reliable environmental information of European importance. The aim here is to support the development and implementation of environmental measures in the Community and the member states. Since 1994, the UBA has operated at the German National Focal Point (NFP) for the EEA. Information can be found on the Internet at: nfp-de.eionet.eu.int.

The EEA has become widely known through well-founded reports on the environmental situation throughout Europe and in the EU. In 2000, the EEA published its first indicator report [1] as well as a report on the integration of transport and the environment in the European Union based on indicators [2].

In 2000, the EEA was the first of eleven EU agencies that enlarged to embrace the EU candidate states. Following ratification of the agreement with the European Commission, Bulgaria, Estonia, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Czech Republic, Turkey, Hungary and Cyprus will be able to work in the EEA.

A large portion of the work performed by the EEA is carried out in the European Topic Centres (ETCs). A new structure was adopted for these centres in 2000. The following five new ETCs were set up in the spring of 2001:

- ETC Water
- ETC Air and Climate Change
- ETC Waste and Material Flows
- ETC Nature Conservation and Biodiversity
- ETC Terrestrial Environment

The UBA will assume responsibility at the ETC Air and Climate Change in the field of climate. Comprehensive information concerning the EEA can be found on the Internet at: www.eea.eu.int. *(I 1.2)*

The United Nations – climate and biodiversity as examples

Within the scope of the UN, staff from the UBA are primarily involved in the Commission for Sustainable Development (UN-CSD), in climate protection, in the Economic Commission for Europe (UN-ECE), the UN Environmental Programme (UNEP) and in the special Organizations of the UN, for example, the International Maritime Organization (IMO), the International Civil Aviation Organization (ICAO) and the World Health Organization (WHO).

We will now take a closer look at the UN-ECE as one example. The Committee on Environmental Policy is laying the political foundation in the field of environmental protection and sustainable development (refer also to chapter 3) and developing international environmental legislation and international efforts in the region. Its tasks also include the further development of the five cross-border environmental conventions of the ECE area:

- *UN-ECE Convention on Long-range Transboundary Air Pollution – LRTAP, Geneva 1979*
- *Espoo Convention (UN-ECE Convention on the Environmental Impact Assessment in a Transboundary Context, 1991)*
- *UN-ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes, Helsinki 1992*
- *UN-ECE Convention on the Transboundary Effects of Industrial Accidents, Helsinki 1992*
- *Aahrus Convention (UN-ECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, 1998).*

Further information can be found on the Internet at www.unece.org/env.

Two examples for environmental activities under the leadership of the UN are the United Nations Framework Convention on Climate Change and the agreement on biological diversity, both of which were the result of the 1992 United Nations Conference on Development and the Environment in Rio. Further information concerning these two conventions can be found in chapters 3 and 7. *(I 1.2)*

The UBA is one of the players involved in the area of biological diversity. This includes – as formulated by the UNEP in 1992 – diversity within and between species, as well as diversity of eco systems. The outstanding result achieved in 2000 was the passing of the *Cartagena Protocol on Biosafety* in February (refer to chapter 11) following lengthy negotiations.

In May 2000, the 5th Conference of the Parties to the Convention on Biological Diversity was held in Nairobi. The Agency was primarily involved in the preparation of three topics:

- Sustainable use
- Eco system approach (refer to Part 2, page 118)
- Exogenous, invasive species (refer to Part 2, page 120).

Based on the results of international negotiations, national measures must now be developed in order to implement the decisions adopted in Germany. The comprehensive and efficient exchange of information is a prerequisite for working on an international and national level. This is carried out primarily via the clearing house mechanism (page 172) on the Internet. The address: www.biodiv.org for the secretariat and the central topics of the convention and www.biodiv-chm.de for the national focal subjects. These websites not only contain all the resolutions, measures adopted and additional information, but also the case studies by the UBA referred to. *(II 1.1)*

International standardization – construction products as an example

Within the scope of international standardization activities in the field of environmental protection, staff from the UBA are working in the International Standardization Organization (ISO) and in the European Committee for Standardization (CEN).

Just how important standardization matters are for the environment and human health will be illustrated by the example of construction products. From the brick stone to the wallpaper, these products are to be traded freely within Europe. In order to implement the single market, the *EU Directive on Construction Products (89/106/EWG)* foresees harmonization on the basis of the "New Approach". This means that directive itself merely sets the framework and delegates the technical details to the European standardisation and approval authorities. If a manufacturer warrants that he has produced construction materials according to the new harmonized standards and approvals, he is then entitled to use the CE mark (Figure 1) for these products and to market them throughout Europe.

Figure 1: CE mark

The fact that standards govern many technical details of everyday life, for example, the stability of buildings, is an essential element of our technical and economic infrastructure that has been established for many decades now. What is new here, is that privately run standardization bodies (for example, the German standardization Organization, DIN) are also defining details of public matters, such as environmental protection and the protection of human health.

Although standardization is based on the principle of consensus among all the parties affected, in practice, it is in fact strongly marked by manufacturer interests. Furthermore, even questionable substances, such as the wood preservative pentachlorophenol (PCP) or formaldehyde used as a bonding agent and preservative in building materials, are far from being banned in all member states or regulated to the same extent. It is also important that European standards are not merely restricted to the smallest common denominator and that requirements related to environmental and health protection are not completely discarded.

The implementation of environmental and health protection in the European construction standardization process was hence established as a core task for the UBA in 2000. The UBA is to ensure that the level of protection that already exists in Germany is maintained, to establish product-specific limit values and to put new scientific findings into practice in the standardization of construction products. Within the scope of this work, the UBA has commissioned the Berlin-based Deutsches Institut für Bautechnik with a research project which, for the first time ever, is to compile up-to-date knowledge concerning construction materials, dangerous substances, emissions, statutory and voluntary regulations in a pan-European reference work.

Draft standards and approvals are being examined with a view to their potential environmental and health effects on soil, water and indoor air. The criteria already enacted are being implemented in standards and approvals via national and international committees. It is particularly here that those requirements, which have not yet been laid down in legal provisions, are integrated, for example, the restriction of emissions of volatile organic compounds (VOCs) in the indoor air (refer also to chapter 8) or the release of hazardous substances into soil and groundwater. *(III 1.4)*

The Organization for Economic Co-operation and Development (OECD) – transport as an example

The Organization for Economic Co-operation and Development (OECD) is currently made up of 30 states from different continents. Apart from the EU member states, these include, for example, the US, Canada, Japan, Australia, New Zealand, Mexico, Hungary, Czech Republic, Poland and South Korea. Within the OECD, the Environment Policy Committee is the executive committee for environmental protection matters. Various work groups and work teams are addressing a host of issues, such as the integration of environmental and economic policy, climate protection, chemicals, waste management, transport, biological diversity (biodiversity) and environmental data. Just recently, the OECD published Environmental Performance Reviews of the member states. Within the scope of its environmental reporting, the UBA supplies the environmental data for Germany (refer to chapter 4). UBA staff are primarily represented in sector-specific working groups, in particular, related to the comprehensive programme on chemical substances. *(I 1.2)*

In 2000, the OECD completed the first round of environmental policy testing in its 29 member states. Prior to commencing the second round of tests for Iceland and Germany in autumn 2000, the testing method was analysed and further developed by a steering group in which the UBA was involved. The group suggested, for example, to pay particular attention to the social aspects of sustainable development (refer to chapter 3) during the testing, to check the performance of environmental policies on the basis of indicators and to reduce the test cycle from formerly eight years to five to six years in future. The conclusions and recommendations gained in each of the most recent tests as well as the report on the most important results of the first round can be found on the Internet at www.oecd.org, under "Environment". The OECD's stock-taking for Germany painted a positive picture. Existing deficits have been identified in the international implementation of EU guidelines, in agriculture, basins, and development aid. Environmental co-operation with the countries in central and eastern Europe is also be to continued. *(IV 1)*

The UBA also participated in the OECD's "Environmentally Sustainable Transport", (EST) project with a case study for Germany. Apart from Germany, Sweden and the Netherlands also contributed national case studies. France, Austria and Switzerland submitted a joint survey on transport in the Alps region, whilst Canada provided a survey on the Quebec-Windsor corridor and Norway a survey on the greater Oslo area. Joint aims were then defined for sustainable transport development and scenarios were drafted with which these aims are to be achieved. Finally, measures were defined, strategies were drawn up to reach these sustainability aims and, furthermore, the economic and social implications were examined.

The results suggest that sustainability (refer to chapter 3) in transport is possible, that there are different paths on the road to sustainable transport development and that the effects on gross national product and employment tend to be relatively insignificant. [2] *(I 3.1)*

The North Atlantic Treaty Organization (NATO)

Environmental protection is also becoming increasingly important in defence policy. The North Atlantic Treaty Organization (NATO) employs a special committee that is responsible for defence aspects with implications for environmental protection: the NATO Committee on the Challenges of Modern Society (NATO/CCMS). On behalf of the BMU (Federal Ministry for the Environment), the UBA is involved there in a pilot study "Erarbeitung eines internationalen Entwicklungsstandes innovativer Techniken zur Altlastensanierung" [Developing an international overview of innovative technologies for clearing up contaminated sites] (refer to Part 2, page 138).

Co-operation with central and eastern Europe

Assisting the candidate countries in central and eastern Europe (Estonia, Latvia, Lithuania, Poland, Rumania, Hungary, Slovenia, Czech Republic and Slovakia) in implementing the environmental standards of the European Union is one of the paramount tasks to be accomplished during the course of EU expansion. The environmental situations in the individual candidate countries, however, differ considerably.

The Union's high level of environmental protection is also to be expanded on the basis of the Copenhagen criteria to the new member states. In order to reach this goal, the EU Commission has adopted supporting subsidy programmes for various legal areas, including environmental legislation. The Twinning Programme is one of these programmes. Its main instrument is partnerships (twinnings) between public institutions of the EU member states and a candidate country.

The actual co-operation is carried out in the form of projects in all environmental areas. During the course of these projects, the technical and organizational experience gained by the member states whilst implementing and applying European law is to be conveyed to the candidate countries. The aim of these projects is to adopt EU legislation. This is why the required administrative structures are to be set up in order to implement the law. One important factor here is the deployment of consultants for long and short terms in order to provide onsite support for the administrations. Since 1999, the UBA has been working on behalf of the BMU (Federal Ministry for the Environment) on a series of projects and sub-projects, often together with other member states. Some of these projects will be presented in Part 2. The main task of each twinning project is to send experts from the administration of an EU member state to the respective candidate country. The actual work of harmonising Union legislation must then be carried out by the ministries of the candidate country. The EU long and short-term experts working in the ministries and other institutions and applying their own particular experience help to ensure that the targets set and laid down in writing in the agreements are reached within the scheduled timeframe. In practice, this usually ends in a very concrete exchange of knowledge and experience.

After the Transform Programme (page 96) was finished, a new consultancy assistance program for environmental protection was created at the beginning of 2000. This is intended for central and eastern European (CEE) countries as well as the new independent states (NIS), i.e. the countries that have emerged from the former Soviet Union. On behalf of the BMU (Federal Ministry for the Environment), the UBA is responsible for the administrative handling and technical management of the measures that are being carried out within the scope of this programme. The aim of the programme is to provide bilateral support for the process of introducing demanding environmental standards (in line with the EU's environmental legislation) in the target countries. The UBA is hence contributing towards strengthening sustainable, environmentally compatible development and is supporting the "Environment for Europe" process as well as the environmental action programme (EAP) for central and eastern Europe agreed to by the environmental ministers of the UN Economic Commission for Europe (UN-ECE, see above).

The "Environment for Europe" conference of ministers held in Lucerne in 1993 launched two international forums designed to support the environmental campaign programmes for central and eastern Europe as well as the countries that emerged from the former Soviet Union:

- The EAP Task Force with the secretariat based in the Organization for Economic Co-operation and Development (OECD) in Paris (www.oecd.org/env/eap/aarhus.htm)
- the Project Preparation Committee (PPC) based in the European Bank for Reconstruction and Development (EBRD) in London (www.ebrd.com)

The EAP Task Force helps the CEE and NIS states to set up administrations and institutions in the environmental sector and to promote the integration of environmental issues in the process of economic restructuring. The main topics of the new work programme for the CEE countries are:

- the introduction and integration of environmental issues in policy planning;
- financing environmetnal protection und
- environmentally orientated management in comapnies.

During the implementation of its tasks in the CEE countries, the EAP Task Force is supported by the Regional Environmental Centre for Central and Eastern

Europe (REC) that has its headquarters in Szentendre (Hungary). Further information can be found on the Internet at: www.rec.org. The new work programme for the NIS countries focuses on the following areas:

- strengthening policies related to the environment,
- financing environmental protection and
- supporting reform, in particular areas, e.g. drinking water supply.

(I 1.2)

International marine protection

Protecting the seas is vital for the long-term protection of mankind's resources. Pollution from shipping and from the land must be widely restricted through environmental protection measures. Within the scope of protecting the seas and international basins, the staff of the UBA are also working in the Oslo-Paris Convention for the Protection of the North-East Atlantic (OSPAR), in the Helsinki Commission – Baltic Marine Environment Protection Commission (HELCOM) and – last but not least – in the international commissions for the protection of the Elbe, Danube, Oder and Rhine (IKSE, IKSD, IKSO and IKSR, refer to chapter 2).

In 2000, a new work structure came into effect at OSPAR. The formerly independent work groups on point sources (POINT) and on diffuse sources (DIFF) were merged to form one work group: PDS (Point and Diffuse Sources) where emissions of prioritary hazardous substances are jointly dealt with. This group is headed by the Hazardous Substances Committee (HSC). This is where measures are negotiated that are specially related to marine protection and the OSPAR strategy on dangerous substances (stopping emissions by the year 2020) and that are not already covered by EU initiatives. This is carried out on the basis of background reports that are being prepared for each of the prioritary substances, currently 27 in number (primarily persistent organic substances and heavy metals). With the special aim of marine protection and the possibility to make binding "decisions", OSPAR is in a position to take on an important role in the harmonisation of the precautionary environmental protection in industrial plants. Further information can be found on the Internet at: www.ospar.org. *(III 2.1)*

The work group on Agriculture at the HELCOM is responsible for drafting recommendations for the reduction of nutrient immissions from agricultural sources. Germany has been the leading member of this group since 1999 (Federal Agricultural Research Centre together with the UBA).

A first important step towards achieving the aims set was the drafting of a code of conduct for the agricultural sector that was adopted as Annex III of the Helsinki Convention. This code of conduct will become binding for the Baltic Sea states in 2002 (and starting 2011 for Estonia, Latvia, Lithuania, Poland and Russia). These activities also help the EU candidate countries to prepare themselves for adopting EU environmental legislation.

Another task being carried out by this work group is the elimination of agricultural "Hot Spots". These are also understood as regionally restricted areas where agricultural activities cause above-average pollution for the marine environment. The list of agricultural "Hot Spots" includes 17 such areas which are primarily characterized by intensive farming. Measures designed to improve the environmental situation have already been adopted in most areas. Further information concerning HELCOM with texts and documents can be found on the Internet at: www.helcom.fi. *(I 1.4)*

Regional efforts – the Alps and the Baltic Sea area as examples

The *Alpine Convention* that came into force on 9 March 1995 is a comprehensive policy for the protection and sustainable development of the Alpine region. The signatories (France, Italy, Liechtenstein, Monaco, Austria, Switzerland, Slovenia, Germany, as well as the European Union) undertake to adopt a uniform policy for the preservation and protection of the Alps whilst "observing the principles of prevention, as well as the polluter-pays and co-operation principles" and ensuring the conscious and sustainable use of resources. They have also agreed to improve cross-border co-operation in the Alpine region and to expand this both geographically and in terms of content.

In order to implement this framework convention, the following protocols of execution have been drafted and adopted: management of mountain regions, mountain forests, soil protection, energy, protection of nature and landscape, land use planning and sustainable development, tourism, transport and resolution of

disputes. The UBA was strongly involved in the drawing up of the protocol on the resolution of disputes. This was later needed because problems arose, above all, in the field of common transport policy.

In order to promote the implementation of the Alpine Convention, an international work group has been set up and is working on the mountain-specific aims for environmental quality (refer to Part 2, page 119). The UBA was appointed to chair this group. After submission of the final report (available on the Internet at: www.umweltbundesamt.de), the mandate for the work group was renewed.

Further information concerning the Alpine Convention, the protocols and international activities can be found on the websites of the International Committee for the Protection of the Alpine Region, CIPRA (www.cipra.org), the network of Alpine conservation areas (alparc.ujf-grenoble.fr) and the community network "Alliance in the Alps" (www.alpenallianz.org).
(II 1.1)

Another example of such regional efforts is the Baltic Sea area. At the meeting of the Council of the Baltic Sea on 22 and 23 June 1998, the foreign ministers of the Baltic Sea states adopted an agenda (refer to chapter 3) for the Baltic Sea area with the goal of the sustainable development of the Baltic Sea, encompassing economic, social and environmental aspects. The name of this agenda: Baltic 21.

The Council of the Baltic Sea appointed a Senior Officials Group to implement this process. The work is carried out by a secretariat based in Stockholm and involves eight sectors: energy, education, fisheries, industry, agriculture, tourism, transport, forests as well as regional planning. Each of this sectors has a lead party that manages the activities in their respective sector. Germany, together with Latvia, was appointed lead party for the transport sector. Cross-sector activities are also currently being carried out in seven joint actions.

Further information on the Action Programme and Agenda 21 in its entirety for the Baltic Sea area can be found on the Internet at www.ee/baltic21. *(I 1.2)*

Protection of the Antarctic

The environmental protection protocol on the *Antarctic Treaty* from 1991 placed the area south of the 60° south latitude line under special protection. This area was declared to be a nature reserve dedicated to peace and science. The German *Implementation Law* of 1994 that incorporates international standards in national legislation has, in this context, assigned a series of tasks to the UBA. The Agency is also responsible for approving activities in the Antarctic region, for the protection of flora and fauna, and – in co-operation with the operators of research stations and ships – for matters of waste management. Some concrete examples can be found in Part 2, page 106.
(I 2.4)

[1] Environmental Signals 2000 (Environmental assessment report 6). Copenhagen: EEA 2000 (ISBN 92-9167-205-X)

[2] Are we moving in the right direction? TERM 2000 (Environmental issues series 12). Copenhagen: EEA 2000 (ISBN 92-9167-206-8)

2. International aspects of plant safety

Overview

- Water protection in Romania, Moldavia and the Ukraine
- Improved plant safety in Russia
- International basin commissions
- Germany – US: the concept for concentration guide values for industrial accidents
- Conference of the Parties to the UN-ECE Convention on Industrial Accidents

Introduction

Environmental protection is one of the global challenges of the new millennium. The cyanide accident in Romanian town of Baia Mare, which will be discussed at a later stage, is a sad example of the prominent role which plant safety and disaster protection will play in this respect. This is the reason for the international involvement of Federal Environmental Agency (UBA) in the various fields related to the safety of industrial plants. This primarily involves co-operation in committees in international Organizations in order to harmonise both legislation and safety standards (refer also to chapter 1). Furthermore, the UBA is carrying out on a number of projects in order to support central and eastern European countries. The concrete support for these countries relates to the transfer and establishment of the European Union's (EU) plant safety standards, with the transfer of information and technology serving as the platform for this drive. These projects are funded by newly created consultancy budget of the Federal Ministry for the Environment (BMU).

Water protection in Romania, Moldavia and the Ukraine

The serious industrial accident at the plant of the Australian mining company Esmeralda Exploration at Sasar near the city of Baia Mare (Romania) demonstrated the urgent need to improve the protection of waters against pollution caused by industrial plants within the scope of **TECHNOLOGY TRANSFER**. On 30 January 2000, a leak in the sedimentation basin caused the release of some 100,000 m^3 of alkaline solution containing heavy-metal salts from the company's gold treatment operations via the Szamos river into the river Tisa and ultimately into the Danube. The fish population was seriously affected over a length of 700 river kilometres. The UBA launched a project together with Romania, Moldavia and the Ukraine in order to avoid future accidents of this kind. Taking the specific conditions of these different countries into consideration, the project aims at transferring technical know-how and at recommending and implementing alternative technical and technological changes.

As a concrete measure, **ACCIDENT-RELEVANT INDUSTRIAL COMPLEXES** are to be inspected in all three countries. These efforts will focus on chemical plants, refineries, metal-processing companies with electroplating operations, as well as large sites where hazardous substances are stored. This programme is expected to generate the proposed measures for alternative technologies to be implemented in the short, medium and long term in order to ensure a safety level which will approximately correspond to EU standards. These standards are to be used by regulatory authorities in order to impose safety requirements. Furthermore, industrial companies can use these standards and the information contained there when preparing investment decisions. What's more, the project is also expected to improve cross-border com-

Technology transfer: *The transfer of advanced technologies to newly industrialized and developing countries in order to boost technical expertise.*

Accident-relevant industrial complexes: *Facilities handling dangerous goods to such an extent that serious danger for man and the environment cannot be ruled out after accidental release.*

munications between public authorities concerning industrial accidents and imminent dangers.

The project was split up into two separate sub-projects. The first part is to focus on studies in Moldavia and Romania, whilst the second part (2002 to 2004) will primarily deal with ongoing work in the Ukraine.

Improved plant safety in Russia

On the basis of the agreement between the governments of Germany and the Russian Federation of 28 May 1992, funds have been made available for transfer of technology and plant safety projects in Russia since 1994. The situation in Russia's – still mostly state-owned – companies is alarming. It calls for quick action in order to improve the safety level of accident-relevant plants. In 1995 alone, around 337 incidents or cases of serious damage were recorded in Russia, causing 143 deaths and an estimated total damage of 420 billion roubles, with Moscow being particularly exposed with its numerous accident-relevant plants and its dense population.

Ammonia-based refrigerating equipment in Moscow: These activities include a project that was launched by the UBA in September 2000 that aims at improving the safety of ammonia-based refrigerating equipment with the example of cold stores in Moscow. The cold stores are related to the particularly critical issue of ensuring reliable supplies of food suitable for consumption to the city's population. This project has hence positive implications for the reform programme underway in the Russian Federation and for ensuring political and social stability.

Russia is currently operating a large number of cold stores which were built during the 1930s to 1960s and which still represent the then state of the art. The refrigerating installations are characterized by large amounts of recirculating ammonia, worn equipment and obsolete technology, so that there are substantial shortcomings in terms of equipment reliability and safety. These problems are also exacerbated by the fact that a major part of these stores are located in the immediate vicinity of residential areas which have grown around large cities. Accidents thus mean an immediate threat for the population.

Ways for technological, ecological and commercially viable modification of refrigerating equipment are now to be examined and concepts developed in order to improve the safety of ammonia-based refrigerating equipment in selected cold stores in the greater Moscow area.

This will be achieved by defining the components of technical modernisation in a pilot project that is exemplary for the entire Russian Federation and by presenting the resultant implementation variants. With a wide range of individual measures, German manufacturers and suppliers of environmental technologies will be given the opportunity to introduce their products to the Russian market. [3]

Safe ways of storing chlorine: Another UBA project investigates ways for the safe storage of chlorine in large urban waterworks and waste water treatment plants. This model project is important for all of Russia because this outmoded and unreliable disinfection technology is common throughout the entire country. The situation is particularly urgent when it comes to the treatment of drinking water from the Moskva and Volga rivers for the city of Moscow. Around 12,000 tons of chlorine per annum (tpa) are consumed here. Storing the required large amounts of chlorine poses an enormous threat to the population.

The aim is hence to develop a concept that is capable of being generally transferred to other Russian cities in order to introduce alternative technologies to replace the present, dangerous chlorine-gas disinfection plants for drinking water and waste water treatment. The content of absorbable organic halogen compounds (AOX) in urban drinking-water supply networks and surface waters is also to be reduced at the same time.

A German/Russian team is examining ways of reducing the danger to man and the environment caused by the water chlorination plants of Mosvodokanal AO. Recommendations are being developed for the equipment to be installed (control and instrumentation equipment, use of liquid-chlorine pumps, necessary shut-off equipment, special valves), as well as the capital investment needed for other special safety equipment. The aim of this effort is to create an investment agenda designed to combat the threats posed by Mosvodokanal's technical chlorine handling equipment and to support the transfer of state-of-the-art processes from Germany.

Pipeline safety in the St. Petersburg region: Russia's gas and oil pipelines made the headlines in recent years with a series of serious accidents, each causing substantial environmental pollution. The Russian pipelines are now in a critical condition because of their age, the prevailing, extreme climatic conditions and the partly inadequate safety level of their technical equipment. Furthermore, insufficient surveillance and monitoring are a threat to the environment and the population.

Whenever pipelines are used to transport environmentally hazardous substances – such as fossil oil or fossil-oil products – environmental and health protection aspects call for the implementation of a sensible safety and security concept in order to avoid and restrict damage. Leakage detection systems are a central part of any such concept, and have been state of the art in western Europe for many years.

Within the scope of the environmental protection consultancy programme in the central and eastern European countries, as well as in the new independent states, the UBA is running a project for the installation of two leakage detection systems for a Russian pipeline as a demonstration project. A central key to the success of this project is the co-operation between German and Russian contractors. The project has been split up into two phases, with the second phase being funded by Kreditanstalt für Wiederaufbau (KfW). It is based on the 1998 transform project "Konzeption eines Leckageerkennungssystems an der Pipeline Kirishi-Batareinaya Bucht als Grundlage zur Einführung des einheitlichen staatlichen Ökomonitoringsystems EGSEM" [Development of a concept for a leakage detection system at the Kirishi-Batareinaya Bay pipeline as the basis for introducing a uniform governmental eco-monitoring system EGSEM].

With the help of the pipeline monitoring data transmission concept to be developed and the subsequent demonstration of the viability of the system, this project will contribute towards reducing the risk of environmental and health damage posed by Russia's pipelines. A model experiment in the St. Petersburg region will be one focal point. A data transmission concept was adapted to Russian conditions and completed during the first phase of the project in close co-operation with the user. The next step will be to implement and demonstrate the leakage monitoring systems. The project will be completed in 2001 with training programmes for operators and Russian authorities. Plans also exist to produce a training video in order to introduce leakage monitoring to as many parts of Russia as possible.

International basin commissions

Plant safety and accident prevention programmes by the international commissions for the Rhine, Elbe, Oder and Danube are contributing towards the harmonization of procedures and legislation for the protection of waters against pollution caused by industrial plants in Europe. All the international commissions hence declared measures for improving accident prevention and plant safety with regard to accident-related water pollution as a prominent aim.

Work groups are hence addressing the issue of technical and organizational measures for improved accident prevention with the long-term aim of harmonised approval and monitoring policies in the member states. The UBA is the leading member in Germany for the project.

Internationale Kommission zum Schutz des Rheins (IKSR) [International Commission for the Protection of the Rhine]: Since the IKSR took up its work quite early because of the Sandoz incident in 1986, this commission has assumed a pioneering function in relation to other basin commissions that were later established. The fundamental requirements for the protection of waters against pollution caused by industrial plants derived from IKSR's recommendations have consequences beyond the basin commission in that they serve as templates for the contents of EU guidelines or ECE conventions (see below). The commission's recommendations have been compiled in the meantime and are available on the Internet at www.iksr.de.

Internationale Kommission zum Schutz der Elbe (IKSE) [International Commission for the Protection of the Elbe]: The *International Convention for the Protection of the Elbe* was the first treaty signed by reunified Germany. Reflecting this importance, IKSE's work for incident prevention and plant safety has become a blueprint for central and eastern European states in their approach towards the EU's safety standards. As a result of the above-mentioned cyanide accident, a stock-taking of all the risk-prone plants was carried out under the guidance

of the UBA and adopting an approach developed by IKSE. This stock-taking exercise, which is scheduled for completion by the middle of 2001, is now about to be expanded to include the entire Danube basin. Furthermore, IKSE has urgently recommended a model project for developing an accident balancing system for field data in order to improve the monitoring situation of the Elbe basin. In July 2000, the UBA commissioned the Prague-based Masaryk Water Research Institute with the project "Accident monitoring in the Elbe basin and development of alarm criteria for international hazard prevention plans" in order to implement these policies.

An immission-orientated evaluation framework for the International Warning and Alarm Plan for the Elbe (IWAE) was to be developed as a result of this project. The reason for this is that a substantial number of undisclosed accidents involving hazardous substances must be expected for the Elbe. This is suggested, on the one hand, by an above-proportion share of oil accidents compared to other river systems during recent years and by the insufficient safety condition of the technical equipment of many chemical plants along the Elbe on the other. Estimates from 1996 and 1997 indicate that the incident exposure on the Elbe is 100 times higher than on the Rhine. Most of this exposure is due to accidents in the Czech part of the Elbe basin.

Certificate of recognition by the US Environmental Protection Agency for UBA's "AEGL team". (Photo: UBA/Hagbeck)

Internationale Kommission zum Schutz der Donau (IKSD) [International Commission for the Protection of the Danube]: In the follow-up studies in the aftermath of the Baia-Mare incident that has already been mentioned several times, the UBA has taken the leading function for the accident prevention exercise. Experts commissioned by the UBA are, for instance, currently developing a short, medium and long-term plan of action for increasing the safety of particularly risk-prone plants in the Tisa basin. Furthermore, the entire stock-taking effort for the Danube basin with a view to accident-relevant plants is being evaluated under the leadership of the UBA [4].

Comparable activities are planned for the countries affected by the Kosovo conflict within the scope of the Stability Pact.

Internationale Kommission zum Schutz der Oder (IKSO) [International Commission for the Protection of the Oder]: IKSO was established in 1994 and is hence the youngest basin commission. At the same time, this marked the closing of the last gap in cross-border co-operation for surface waters for Germany. So far, however, only the international warning and alarm plan for the Oder was developed on the basis of the Elbe warning and alarm plan in the field of plant safety. The establishment of the technical/scientific secretariat of IKSO in Wroclaw will probably increase momentum to a certain degree. A co-operation project beyond the scope of this trilateral commission (Germany, Poland, Czech Republic) has already been promoted by the UBA on the basis of the bilateral environmental conventions with Poland and the Czech Republic (see below).

Germany – US: the concept for concentration guide values for industrial accidents

Various guide or value recommendations exist for the evaluation of air pollution concentrations following industrial accidents. One of the scientifically best-founded and at the same practically orientated concepts for developing such values is the acute exposure guideline levels (AEGL) which was developed under the leadership of the Environmental Protection Agency (EPA) in the US. This concept has already gained international importance. According to recommendations by the commission on industrial acci-

dents, the AEGL concept is to be applied in Germany too. This is why the UBA has been promoting a co-operation with the US AEGL committee since 1998. The first phase of this co-operation was concluded at the end of 2000.

On behalf of the UBA, AEGL recommendations have been developed for a total number of six substances up till now which were validated by a body of national scientists belonging to the commission on industrial accidents. Three of these AEGL substances were already discussed and positively examined by the US AEGL committee. Germany has promised to submit technical support documents for another 20 substances by 2005. The final report on the first phase of this co-operation will be available on the Internet as of May 2001 at www.umweltbundesamt.de.

One interesting fact should be added: during a ceremony held on 8 January 2001, the EPA honoured the members and supporters of the AEGL team with a certificate. The achievements by the UBA and its research contractor, FoBiG GmbH, Freiburg, Germany, were also honoured on this occasion.

Conference of the Parties to the UN-ECE Convention on Industrial Accidents

From 22 to 24 November 2000, Conference of the Parties to the *UN/ECE Convention on the Transboundary Effects of Industrial Accidents* was held in Brussels. (UN-ECE being the United Nations Economic Commission for Europe.) This convention came into effect on 19 April 2000 after Croatia had submitted the ratification document as the 16th country. Germany had already signed the convention in 1998. Several new obligations with legally binding effect were discussed and adopted. The documents underlying the resolutions are available on the Internet at www.unece.org/env/teia/english/doc.

This concerns several areas, including the following:

UN-ECE Industrial Accident Notification System: Under this system, national notification centres must be set up as contact points for accident notification and requests for help – in Germany, this is the operations room at the German Federal Ministry of the Interior (BMI). Accident notification by the contact points can also be channelled via an equivalent reporting system. This ensures that tried-and-tested notification systems – such as the international warning and alarm plan for the Rhine (see above) can continue operating as before. Smaller accidents of regional relevance with cross-border repercussions can be handled via the local and regional institutions of the countries.

Guidelines for the identification of "hazardous activities": This document confirms the conformity of operations which are subject to the *Seveso-II guideline* "upper tier" with the "hazardous activities" according to the industry convention. This strongly simplifies the implementation of the convention by the EU member states in identifying "hazardous activities". Concerning "cross-border effects", a distance of 15 km from the border was recommended as a first, pragmatic approach towards the definition of the air path, whilst the river basin was recommended for the water path.

Liability issues: The need for suitable procedures, "including a legally binding instrument in the UN-ECE region for civil liability for damage caused by hazardous activities" is recognised. The secretariat of the Convention on Industrial Accidents was commissioned to prepare a joint special meeting together with the secretariat of the water convention within the scope of the two conventions.

By 21 March 2002, the parties must submit a first national report on the implementation of the Convention on Industrial Accidents to the UN-ECE secretariat. The UBA is preparing this report for Germany.

(III 1.2)

[3] The project is to be concluded by a workshop in 2001. The final report will then be available from the library of the Federal Environmental Agency (address on page 94).

[4] The report is to be submitted by the middle of 2001 and will be available from the secretariat of IKSD, Vienna International Center D 0412, Postfach 500, 1400 Vienna (Austria).

3. Sustainable development activities

Overview

- Introduction
- The Local Agenda 21 process in Germany
- Local public participation
- Sustainable settlement development
- Sustainable mobility in cities and regions
- Fair trading of products from developing countries

Introduction

Ten years after the so-called Rio Conference, the United Nations Conference on Development and the Environment held in 1992 in Rio de Janeiro (Brazil), the World Summit on Sustainable Development is to be held in September 2002 in Johannesburg (South Africa). The Commission on Sustainable Development set up in Rio has meanwhile worked through all the chapters of **AGENDA 21**. It has now become clear that defining a concept for **SUSTAINABLE DEVELOPMENT** is still a difficult task. The matter of financing Agenda 21 – particularly in developing countries – has yet to be clarified. One positive aspect is the move by the Minister for the Environment, Jürgen Trittin, and Klaus Töpfer, Executive Director of the UN Environmental Programme (UNEP), to set up a global environmental organization. With its help, environmental matters would gain much more weight. Following the first UNEP Global Ministerial Environment Forum in Malmo (29 to 31 May 2000) it became clear that the topics put forward by Germany and the European Union (EU)

- Efficiency of resources (in particular for energy and water)
- Poverty and the environment
- Institutions

also met with international interest.

Sustainable development: *sustainable, environmentally compatible development. This was introduced for the first time in 1987 by the so-called Brundtland Commission as a term to describe environmental and development policy. The Rio Conference then advanced sustainable development to the new model for co-operation in environmental and development policy. This is understood as environmentally and socially compatible development that, on a global level and across generations, leads to a balanced relationship between ecological, economic and social factors.*

Agenda 21: *the most important closing document of the "Rio Conference". This documents integrates ecological, economic and social aspects into all political areas and recommends national measures and finance tools for their implementation.*

Through different single initiatives, Germany will work out a national strategy for sustainable development and present this at the summit- this was the resolution adopted by the cabinet on 26 July 2000. A committee, made up of ten permanent secretaries of state from the most important departments related to environmental matters, is responsible for this overall strategy under the leadership of the Federal Chancellery. This committee went into action in March 2001 and is initially working on the subjects of climate/energy/mobility as well as environment/health/nutrition. In addition to this, a council for sustainable development has been established as a dialogue forum for social groups that includes well-known personalities. The aim of this council is to draft contributions for the implementation of national sustainability strategies and to recommend fields of action and concrete projects with which the principle of sustainable development can be put to practice in politics.

Since many of the problems and approaches towards solutions are linked to activities on a local level, the involvement of cities, municipalities and districts is an important factor when it comes to achieving the goals of Agenda 21. To this end, programmes and projects orientated towards sustainable development can be particularly found in the municipalities, and also to a degree in the regions. *(I 1.1)*

The Local Agenda 21 process in Germany

The latest survey results show that Germany's cities and communities have achieved remarkable success

on the road towards sustainable development. In recent years, important measures have been implemented in order to improve living and environmental conditions "on site".

Climate protection and energy, transport and traffic, as well as land use and construction are the focal aspects. For example, many German cities and communities are combining their projects for the reduction of energy requirements in climate-alliance initiatives. Special emphasis must be placed on the numerous exemplary measures by the municipalities designed to promote environmentally friendly transport and traffic, as well as land and resource-saving forms of settlement and construction. Models projects, such as "Städtebauliche Innenentwicklung" [Internal Urban Development] or "Stadt der kurzen Wege" [City of short routes] are characteristic of this process. The aim of future-orientated and resource-saving development in German cities and communities and in their administrations and regional organizations is hence not only linked to the 1992 Conference on Development and the Environment.

More and more cities, communities and districts consider the **LOCAL AGENDA 21** to be an elementary task. Municipalities in Germany can rely on a host of tried-and-tested planning and control instruments that are in place on a municipal level: urban development programmes, development plans, traffic and transport development plans, climate and energy concepts, environmental reports, environmental impact assessments as well as methods for public participation in urban development can be used for a sustainability concept. The Local Agenda 21 offers the opportunity to set new trends for a future-orientated development in the municipalities. It harmonises various political fields more closely with each other, permitting participation by interested citizens as well as groups from society. This makes it possible to measure the steps towards sustainability on the basis of concrete aims and indicators, hence making them reproducible. More and more municipalities in Germany are taking advantage of this opportunity.

The task of the "Local Agenda 21" discussion circle that was established in 1998 from federal and state governments and central municipal organizations is to co-ordinate the many different promotion activities. The BMU (Federal Ministry for the Environment) and the UBA support the Local Agenda 21 process through a host of information and advice offers:

Local Agenda 21 (LA 21): *a control instrument on municipal level design to implement the aims of sustainable development in cities, communities and districts. LA 21 harmonizes the various political fields, promotes the dialogue between municipal administration, regional organizations and private business and drafts aims and measures to be implemented through concrete projects.*

model projects, case studies, work tools, service brochures and specialized events. [5] What has become clear is that municipal administrations and representations have a key role to play, particularly when it comes to the binding nature of the Local Agenda 21 for political decision-making on a municipal level.

Which recommendations and prospects exist for the further Local Agenda 21 process in Germany, above all, compared to the development in other European countries? The UBA commissioned the International Council for Local Environmental Initiatives (ICLEI), in Freiburg, and the German Institute of Urban Affairs (Difu), in Berlin, to carry out the survey titled "Local Agenda 21, a European Comparison", the results of which were published in 1999 [6]. The researchers praised the fact that the enormous range of information and advice offers provided by the BMU (Federal Ministry for the Environment) and the UBA had created an important impetus for sustainable development in the municipalities.

Sustainable mobility – an important subject for the Local Agenda 21. (Photo: courtesy of BMU)

This kind of impetus on a national level, however, should not be restricted to government authorities responsible for environmental and urban development, but should also reach the departments involved in economic and social matters. The national sustainability strategy already referred to and the targeted, framework-forming measures can provide support for effectively implementing the Local Agenda 21 process. This also includes, for example, expanding urban development support, including its financing, through a new programme titled "The social city". The results of the survey indicate that the success of the Local Agenda 21 process is strongly dependent on the municipalities having sufficient policy-making powers, also in financial terms.

In conjunction with the activities pursued on a national level by other institutions, the BMU (Federal Ministry for the Environment) and UBA projects are supplementing the efforts of central municipal associations, the federal states with their agenda transfer points, the non-governmental organizations (NGOs) as well as national and international networks. *(I 2.3)*

Local public participation

The research project "Initiativen für eine nachhaltige Entwicklung: Neue Dialogformen und Kommunikationsstile im Zusammenhang mit der Agenda 21" [Initiatives for sustainable development: new forms of dialogue and communication in conjunction with Agenda 21] examined the question as to which new opportunities and difficulties exist when it comes to greater participation by the public in Local Agenda 21 initiatives. The survey was carried out by the "Verein zur Förderung der Ökologie im Bildungsbereich" [Association for the Promotion of Ecology in Education], Berlin. [7]

Berlin-based initiatives were accompanied in this research project for over a year using social and scientific methods of field research. In addition, the social environment in which the initiatives were trying to make an impact was examined. The greatest problem here was that the term sustainability was widely unfamiliar to the public and rarely brought into the same context as the contents and goals of Agenda 21 (refer also to chapter 4).

This is why it is also very difficult for local initiatives to create a real understanding among the public for their work or to even achieve sufficient public participation in the interest of the issue at hand. The social/scientific observation and analysis showed that the local initiatives usually progress through certain formation stages: this results in an ongoing discussion process, work groups are formed, guidelines are drafted for the work and action catalogues until a local plan of action is finally drawn up. Whilst these stages are usually completed quickly, the subsequent public involvement process often causes great difficulty. This can be explained by the fact that the issues meet with a lack of understanding in the local public. The consequences for the players involved is often resignation and withdrawal from public participation and involvement.

The analysis showed that citizens are in fact very willing to carry out civil/social (honorary) efforts – particularly in conjunction with Local Agenda 21 initiatives. However, this willingness often fails to materialize because the sustainability process itself is still widely unknown as a public opportunity or challenge. *(I 2.2)*

Sustainable settlement development

On a local level, the topic of "settlement development and land use" is a focal aspect of the Agenda 21 process. Every day in Germany, 129 hectares of new land are being taken up for settlement or transport purposes; this corresponds to around 200 football pitches. This kind of development is simply not sustainable, i.e. permanently compatible with the environment, particularly since the settlement and transport areas are a key indicator for a vast range of environmental impacts. This is why in 1998, for the first time ever, the BMU (Federal Ministry for the Environment) formulated the following aim in the Environmental Barometer for Germany (refer to chapter 4), "to reduce the daily increase in settlement and transport areas of over 120 hectares to 30 hectares by the year 2020" (refer also to chapter 10).

In order to clarify which possibilities exist for area-saving settlement development and which strategies and instruments can be adopted for its implementation, the Federal Environmental Agency has commissioned the German Institute of Urban Affairs (Difu), in Berlin to carry out a research project. [8] The key concept here is:

- to stop uncontrolled urban spread,
- to guide urban development demand to inner city districts,
- to ensure the ecological and social quality of urban areas, as well as
- to focus development in the region on settlement areas located near rail transport.

What can be seen is that both in east German and west German cities, there is a vast potential for new buildings in existing settlement areas. This was the result of case studies carried out in the city regions of Cottbus and Hanover. This form of potential is not just to be found in areas and on empty sites, but also includes, for example, adding storeys or attic conversions.

Efficiency scenario: This is primarily based on the reactivation of industrial, military or transport areas, closing empty sites (without using up free space that is valuable in terms of ecology and urban development) and the conversion of attics. The potential for residential building calculated in this scenario could, arithmetically speaking, cover the entire demand for housing in the Cottbus region (by the year 2010) and two thirds of the demand for housing in the Hanover region.

Change in structure and consciousness scenario: This is based on the assumption that changed public framework conditions will foster a new appreciation for living in the city and for environmentally compatible transport. Re-design and urbanisation of existing settlement areas, supplementary functions for diverse types of buildings, adding storeys or expanding or extending buildings are measures through with further potential could be exploited. For the Hanover region, this would mean that its estimated housing requirement could be covered by the year 2010 without having to use up new areas for settlement purposes.

Status-quo scenario: When conditions remain unchanged, however, the settlement and transport areas in the Hanover region will increase annually by 1.24 % and by 1.6 % in the Cottbus region.

Strategies for space-saving settlement development should not, however, be merely restricted to the exploitation of the potential offered by existing settlement areas. At the same time, improvements in urban development are required. If living in the city is to become an alternative to "living in the country" for a greater number of people than before, then an ecological and social improvement in the living environment and inner-city green areas are required. Furthermore, forms of living must be available that can compete with the detached family house. Based on several examples, including those from Bremen, Hamburg and Amsterdam, the survey shows that a high residential quality and homes with a garden are also possible with a medium to high development density of 50 to 100 apartments per hectare of gross building land.

It cannot be confirmed that restricting an agreed building density, currently with a floor space index of 0.8 to 1.0 for residential use, has been reached. On the other hand, it is still possible to achieve a sufficiently residential-based free area with a floor space index of up to around 2.0 when the number of cars is below average. This means that it should not be higher than, for example, in the inner city districts of Amsterdam or Copenhagen (around 200 cars for every 1,000 citizens). It is not only urban development criteria, such as lighting, sunlight and free space, etc. that are setting restrictions for urbanisation, but also the relatively high number of cars in comparable German cities and the pertinent demand for parking space (around 400 to 500 cars for every 1,000 citizens).

This research report provides an important contribution for the implementation of the legislative and programmatic aims of the federal government on a municipal level, expressed, for example, in the soil protection clause in the *Building Code*. At the same time, it provides recommendations for the further development of the framework conditions on a national level, in particular, with regard to interaction between regional planning and economic control instruments. These results are particularly useful when it comes to developing the national sustainability strategy, above all, in the fields of urban development/land use, transport, nature conservation and soil protection.

(I 2.3)

Sustainable mobility in cities and regions

Transport is a focal issue of the Local Agenda 21. Despite this, there are considerable shortcomings in the development of sustainability strategies as well as in their practical implementation.

What is particularly lacking is sustainability aims and indicators in the field of mobility and transport that can be quantified and put into practice. This means that municipalities and regions have no means of identifying their own position in relation to the quality aims or of optimising their steps to overcome these shortcomings. The UBA has commissioned BPI-Consult, Berlin, to develop such aims and indicators within the scope of the research project "Kommunale Agenda 21 – Modellvorhaben: Dauerhaft umweltverträgliche Mobilität in Stadt und Region" [Municipal Agenda 21 – model project: permanently environmentally compatible mobility in cities and regions). Furthermore, the UBA has commissioned BSV Büro für Stadt- und Verkehrsplanung, Aachen, to test these aims and indicators in a model experiment.

In addition to this, the weakness of overall municipal transport planning results in deficits which are largely rooted in shortcomings in legal frameworks. Surveys commissioned by the UBA show this clearly at two points:

- The analsiys of the environmental situation is not always thorough. When considering the facts, this leads to a systematic underestimation of the environmental risks caused by traffic compared to the transport requirements that are usually recorded in full.
- Almost all the municipalities looked at show weakenesses when it comes to implementing municipal transport planning. This is not surprising in view of the fact that they have no legally binding effect. Hardly any community appears to be interested in implementing its own concept. This is a consequence of the legal character of municipal transport concepts. The respective resolution by the community representatives must not be consistently implemented, because failure to observe such resolutions remains widely without any consequences – at least in legal terms.

These deficits can only be by eliminated by legally implemented and legally binding transport and traffic planning. Some key boundary conditions for such an approach are as follows:

- A commitment by communities to a generally comprehensive and trans-media identification of the environmental situation.
- The decision in favour of a certain action concept must be made on the basis of an alternative discussion – for example, based on the concept of developing a tried-and-tested scenario. This process must also pay sufficient attention to the foreseeable effects of various transport and traffic policy options. In this content, the mobility of all members of the community must be inlcuded in these considerations together with the respective impact of transport-induced burdens on human health and the enviornment, as well as the damage to physical assets.
- The transport concept must have legal clout that particularly obliges communal authorities to implement the concept in full.
- Finally, a binding success monitoring system must be installed, so that failure to achieve objectives can be identified and, when necessary, corrective action adopted.

Suggestions for solutions to the problems analysed were developed on behalf of the UBA by the Municipal Transport Planning research group at Hamburg University under the leadership of Professor Dr. Hans-Joachim Koch. The survey submitted at the end of 2000 convincingly shows that the weaknesses identified in municipal transport planning can be effectively eliminated by a *communal transport planning law*. The final report also contains a detailed analysis section together with a substantiated draft for such a law. [9] *(I 3.1)*

Fair trading of products from developing countries

In the interest of global sustainability, fair trade supports disadvantaged producers in economically weak countries that have no access to the global market. The environmental advice project, promoted by the Fair Trade Association, Wuppertal, for the creation of a broad information base for ecological products from and fair trading with developing countries, has been completed with the publication of a manual [10]. The results were presented to the public on 19 April 2000 at a joint press conference by the BMU (Federal Ministry for the Environment) and the UBA.

Examples of fair-trade products include carpets with the "Rugmark" label that are produced without child labour, as well as coffee and cocoa with the "Transfair label" and cut flowers from the "Flower Label" programme that symbolizes the restricted use of pesticides and decent working conditions. Many of these goods have also received eco-certification, including 60 percent of coffee brought on the market by gepa

and half of the "Transfair" tea produced by eco-farming. The proceeds from the sale of these goods go to the producers. They receive not just a fair wage but also training and support for self-help projects.

The manual presents for the first time the most important organizations and companies, as well as the latest product labels from the various fields of need – for example, food, washing, clothing, living, travel. The appendix contains guidelines for the ethical principles and aims of eco and fair-trade initiatives, as well as criteria for environmentally and socially compatible trade with developing countries. This information is also available on the Internet at: www.eco-fair-trade-net.de. *(III 1.3)*

[5] Certain publications by the UBA on the Local Agenda 21 are available free of charge from the UBA's Central Answering Service (address: see page 94). Details of the information and advice offers can also be found on the Internet at: www.umweltdaten.de/rup.

[6] Free copies are available from the UBA's Central Answering Service (address: see page 94).

[7] Gerhard de Haan, Udo Kuckartz, Anke Rheingans-Heintze: Bürgerbeteiligung in Lokale Agenda 21-Initiativen. Analysen zu Kommunikations- und Organizationsformen [Public participation in Local Agenda 21 initiatives. Analyses of forms of communication and organization]. Opladen 2000: Leske + Budrich, ISBN 3-8100-2555-0, available through bookstores.

[8] Szenarien und Potenziale einer nachhaltig flächensparenden und landschaftsschonenden Siedlungsentwicklung [Scenarios and potentials of sustainable, land-saving and landscape-saving settlement development], UBA "BERICHTE" series 1/00, Berlin 2000: Erich Schmidt Verlag, ISBN 3-503-05978-4, available through bookstores.

[9] Available from Department I 3.1 of the UBA (address: see page 94).

[10] Im Zeichen der Nachhaltigkeit; Verknüpfung von Öko- & Fair-Trade Initiativen [In the light of sustainability; linking eco and fair-trade initiatives]. The manual can be ordered by sending EUR 2,60 in postage stamps to Fair Trade e.V., Bruch 4, 42275 Wuppertal, Germany.

4. Information for action: environmental awareness and environmental communications

Overview

- Introduction
- Environmental awareness – a matter of communication?
- Environmental consulting
- Focal issues of information work
- Children and youths as a target group
- Through facts to findings: the "Daten zur Umwelt 2000" report
- Environmental barometer and German Environment Index (DUX)
- UBA data on the Internet: umwelt deutschland, GEIN, Cleaner Production Germany
- Incentive for businesses: eco-audit with certificate
- Data for international reports

Introduction

Providing information on the environmental situation, fostering environmentally conscious actions – these are two key tasks for the Federal Environmental Agency (UBA). The agency provides information ranging from energy-saving tips for private homes to complex substance data and calculations for international bodies. How effective is the UBA's work in the field of environmental communications? Does the information actually reach the target groups, and does it produce the desired effect there?

In recent years, the importance of environmental information has grown increasingly because it triggers interest in the environment and strengthens environmental awareness. It offers orientation assistance for the public and shows individuals ways in which they can take action. This conclusion is reflected by the *Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention)* that was adopted by the environmental ministers of the UN-ECE states in Aarhus (Denmark) in 1998. (UN-ECE is the United Nations Economic Commission for Europe.) Articles 4 and 5 of this convention set forth the citizens' right for active information and free access to information at public authorities concerning the condition of the environment using electronic means of communication. The draft of a new *EU Directive on Public Access to Environmental Information (2000/0169, COD)* reflects the provisions of the Aarhus Convention to a large extent.

Environmental awareness – a matter of communication?

Environmental issues are currently undergoing hard times. Environmental communication is facing growing difficulties. The rapidly increasing flood of information and appeals with which citizens are being confronted each and every day is just one of the reasons for this. However, there are also other reasons which are inherent to the development of environmental awareness and environmental communication itself. The representative survey "Umweltbewusstsein in Deutschland 2000" [Environmental Awareness in Germany 2000] [11] (conducted by Prof. Dr. Udo Kuckartz, Marburg university, in co-operation with EMNID-Institut, Bielefeld,) has yielded conclusive evidence for this (www.umweltbewusstsein.de).

Since the 1990s, this survey has been regularly commissioned by the Federal Ministry for the Environment (BMU) and the UBA. These polls have been conducted every second year since 1996, with the data being additionally subjected to more in-depth sociological analyses, so that trends and their reasons can be identified. The latest poll found that the following aspects were particularly important:

- The political importance which those polled attach to environmental protection continues to de-

cline. Whilst at the end end of the 1980s, around two thirds of those polled called environmental protection one of the most important, topical political issues, this figure is now down to less than 20 %. This is partly due to the progress in environmental protection which those polled stated to have taken place.

- Judgements concerning the quality of the environment in Germany still vary considerably. 77 % of those polled consider the environment in the western federal state to be "very good" or "relatively good". Almost half of those polled see considerable progress in the field of water quality. In contrast to this, the public is more sceptical about other areas, such as air and soil quality where only 9 % see major progress, whilst 31 % stated that the situation had deteriorated.
- The latest survey showed an increase in environmentally orientated attitudes and values for which a slight decline had been found between 1996 and 1998. 59 % endorsed the statement that the limits of growth were reached (1998: 50 %), 62 % were concerned that an environmental disaster might take place if we were to continue as before (1998: 56 %), 65 % believe that the majority of the population lack environmental awareness in their actions (1998: 49 %), and 67 % stated that politicians were not doing enough for environmental protection.

This means that this survey – long before the BSE crisis (bovine spongiforme encephalitis, "mad-cow disease") which has been making headlines since the end of 2000 – defeats the notion that dominated the second half of the 1990s where it was believed that the condition of the environment and ecological issues in general were becoming less and less important for people.

Current environmental awareness, however, is characterised by a substantial near-far difference in terms of both geographical distance and time: whereas people in Germany consider the environment in Germany and in their municipalities to be very positive, two thirds of those polled consider the quality of the environment world-wide to be "rather poor" and 18 % even as "very poor". Around 90 % of those polled expect substantial global warming and increasing global environmental pollution over the next 20 to 50 years. Citizens are hence fairly sceptical about the "future capability" of current production and consumption patterns. The question concerning approval or disapproval of the principles of sustainable working and living patterns met with very high approval rates, with a minority of less than 5 % of those polled rejecting these principles. However, the key model of sustainable development itself (refer to chapter 3) was still an unknown concept to the largest part of the population, with just 13 % stating that they already heard of it, which means even a small decline against the value from the 1998 survey. 85 % had never heard of a "Local Agenda 21 initiative" (chapter 3) in their own municipality – a bitter pill for all those involved in environmental communications.

Part of the difficulties facing environmental communication is certainly also owed to the fact that attempts to clearly communicate the opportunities of ecological re-orientation in everyday life have so far failed. The "Umweltbewusstsein in Deutschland" [Environmental Awareness in Germany] survey shows that the majority of the population perceive the issue of environmental burdens as a diffuse and global threat. Apart from the occasional "scandal", citizens apparently think that threats have had no direct impact up to now in private, concrete lives. What implications does this have for environmental communications?

In order to boost its efficiency, environmental information and environmental reporting must be improved, for example. What is still needed is a broad-based information effort in order to show environmentally compatible attitudes that can be adopted in everyday life. These are areas in which the UBA offered a host of programmes and projects in 2001.

(I 2.2)

Step by step: environmental consulting

The firm establishment of the "environmental protection" issue in the public eye would be impossible without so-called "intermediary structures". While the "environmental movement" and the media initially addressed and publicly discussed this issue, associations of various pressure groups have now become increasingly involved in this effort since the mid-1980s. Today, associations as players and multipliers of environmental policies have a central role to play in environmental communications and the dissemination of practical knowledge. This is reflected by the joint "Environmental Consultancy Promotion Programme" by the BMU (Federal Ministry for the Environment) and the UBA. The aims of this programme are:

- to establish and develop consultancy structures in associations at a nation-wide level,
- to develop practically relevant information offers and consulting media for the associations' target groups,
- to introduce environmental issues even to associations which do not explicitly pursue environmental aims – such as business associations,
- to create new forms of co-operation and to network environmental policy players,
- to promote campaigns and activitites for information and environmental consulting.

The UBA presented its promotion and support programme at the "Umweltberatung und Nachhaltigkeit" (Environmental Consultancy and Sustainability) conference held on 28 and 29 May 2000 by Deutsche Bundesstiftung Umwelt (DBU) in Osnabrück, Germany [12]. Promotion and support for environmental consultancy projects are primarily orientated towards nationwide projects sponsored by federal associations and parent organizations of environmental organizations with the most varied structures. This drive also focuses on business associations and further institutions and holdings. The task of the environmental consultancy organizations is to introduce the key model of sustainable development (refer to chapter 3), as well as related subjects and issues, to associations and to establish this concept as an orientation frame for day-to-day work. Besides the "private consumers" target group, all the fields and institutions of public life are being addressed where products are bought and disposed of, where energy is consumed, services are offered or information talks held. The UBA has promoted a host of projects in this field (refer to chapter 3, with further examples given in Part 2, pages 94 and following). *(I 1.3)*

Key issues of information work

Environmental information has a tradition in Germany. For almost 30 years, environmental protection issues have been discussed in broad circles of the population. Although, as already mentioned, the priority of environmental issues has declined, this is not a fundamental change.

However, the fact that the majority of the population considers environmental issues to be a problem of the future rather than a present-day problem remains a challenging issue. This means: people consider it to be less important to do something *now* and to rethink their environmentally relevant behaviour *now*. This is the point where dynamic information and persuasion work is needed in order to induce large circles of the population not just to think, but also to do.

Environmental information has passed through two major phases since the beginning of the 1970s. Phase I aimed at achieving a broad consensus in the population in terms of the need for effective environmental action by the state. At the beginning of phase II, efforts were made to motivate citizens to make an active contribution by acting in an environmentally conscious manner. This motivation phase was only conditionally successful in important areas, such as waste management and traffic, and has since been supplemented by effective legislative measures.

Phase III was launched with a set of stringent measures, including, for instance, the *packaging materials ordinance* and the resultant increase in costs for environmentally harmful packaging materials and, in particular, the introduction of the Eco-tax. Environmentally harmful attitudes, such as high energy and fuel consumption, are now directly felt through higher taxes.

On the other hand, environmentally compatible attitudes are starting to pay off. One may expect that this will once again improve the priority of environmental protection in our country in the medium term: environmentally conscious consumption rather than uncontrolled waste of raw materials and energy must become the underlying principle of environmentally compatible thinking. This calls for intensive efforts to provide information that clearly point out the obstacles and opportunities of environmentally orientated attitudes in everyday life.

Information media underwent an important transition at more or less the same time as phase III was introduced. Traditional information media, such as brochures and posters, are increasingly being replaced by digital media, such as CD-ROMs and the Internet. The UBA has broken new ground with its photo competition "Klickital! Meine Umwelt", ("Klickital! My environment") where participants are encouraged to send digitised photos – with an overwhelming response (refer to Part 2, page 97).

The UBA is making use of all the instruments of modern information work in order to communicate topical subjects. This includes print media (leaflets,

brochures, books, posters), as well as electronic media and participation in lectures, symposiums, trade shows and exhibitions. Subjects of particular importance are combined to focal information issues.

One of these focal issues is the "energy" sector and, more specifically, "green electricity". The UBA is focussing its information activities on disseminating the idea that the best electricity is electricity that is not consumed, and that cost-conscious consumers can benefit more from actively saving electricity than from switching to another supplier. One of the information campaigns in this respect used a leaflet with basic information ("stromwen.de") and raffled several thousand measuring instruments for measuring the power consumption of individual appliances and devices (so-called energy monitors suitable for measuring loads of between 1 and 4,000 watts).

Children and youths as a target group

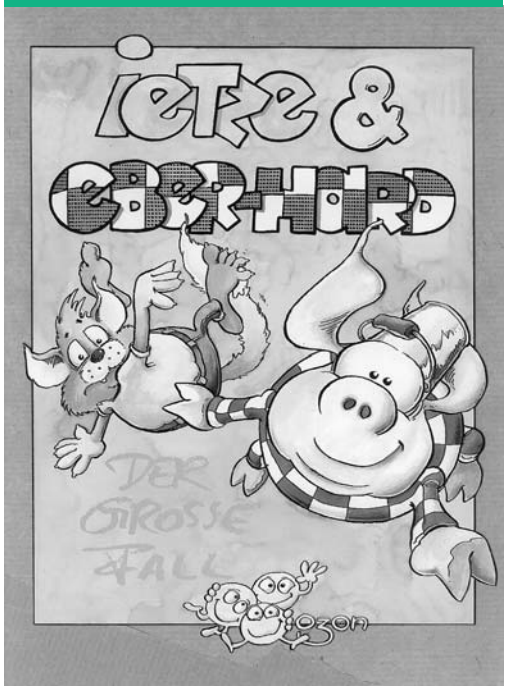
Children and youths are an important target group for the UBA's information work. For many years, the agency's PR department has been offering media designed for different age groups, such as cut-out sheets, painting and puzzle books, comic strips, computer games and other material.

The comic characters "letze and Eberhard" and their very popular stories were developed especially for youths (Figure 2). A new, six-part poster series was produced in 2000 which primarily addresses aspects of sustainable development and which was designed as a touring exhibition for schools. The individual topics include, for example, permanently environmentally compatible forms of energy conversion and use, the environmentally compatible production of consumer goods, as well as issues related to sustainable traffic design. The contents of Agenda 21 and certain youth group projects in the area of sustainable development that deserve special mention are also addressed in a manner suitable for this target group. *(I 1.3)*

Through facts to findings: the "Daten zur Umwelt 2000" report

The protection of natural resources is a public aim laid down in Article 20 of the German constitution. It includes an obligation on the part of the government to provide the public with comprehensive information

Figure 2: environmental issues for the youngsters: letze and Eberhard



concerning the condition of the environment. The state's obligation to provide environmental information is laid down in the *Environment Information Law* of 1994 which implements the EU Directive on Freedom of Access to Environmental Information *(90/313/EEC)*. Pursuant to Section 11 of the Environment Information Law, a report on the condition of the environment must be published every four years. The volume "Daten zur Umwelt – Der Zustand der Umwelt in Deutschland" (Environmental data – the condition of the environment in Germany) published by the UBA is a major step towards fulfilling this reporting obligation (Figure 3). With the present 7th edition, the UBA is already addressing the requirements of the above-mentioned Aarhus Convention.

The economic, ecological and social framework has undergone great change since the report was published for the first time in 1984. Many regional environmental problems have been resolved. For several years, however, Germany has been faced with new issues of a global dimension that can only be resolved on an international level. One of these issues is the global threat to the environment and hence also to mankind's basis of existence through climatic change, triggered primarily by the energy-dependent increase in greenhouse gases in the atmosphere as

a result of non-sustainable production and consumption patterns (refer also to chapters 6 and 7).

For the first time, the contents of the "Daten zur Umwelt 2000" report were compiled and the articles were given a uniform and compact make-up on the basis of a reporting guideline developed by the UBA by reference to the "International Guidelines for Environmental Reporting" issued by the European Environment Agency (EEA). These guidelines set forth the information criteria necessary for a comprehensive description and evaluation of the condition of the environment for each subject.

In order to assess the extent of environmental burdens, changes in the condition of the environment, as well as environmental protection measures taken on a nationwide level, so-called environmental indicators were derived as aggregated orientation parameters derived from field data. Whenever possible, a data base covering up to ten years was used as a basis in order to be able to map trends for the last decade of the 20th century. In order to represent the geographical distribution of environmental burdens in Germany and the possible, local to regional, need for action, field data was used with a high geographical resolution for cartographic environmental maps.

Figure 3: "Daten zur Umwelt 2000"

The demand for data concerning environmental activities and environmentally relevant influence variables is covered primarily by statistics prepared by the federal government and the governments of the federal states, as well as in surveys by business associations, whereas the data needed to describe environmental quality comes from monitoring programmes of nationwide and state-wide measuring networks, technical information gathered by the federal government, as well as measurement programmes on a federal-state level within the scope of the agreement between the federal government and the federal states concerning the exchange of environmental data. The basis for the ongoing provision of data and information has continually improved over recent years. Working groups from federal government and federal states, as well as working teams from the federal states have, for example, developed additional appendixes for the administrative agreement on the exchange of data between federal government and federal states related to water, soil, nature and landscape issues. Furthermore, federal institutions have developed skeleton agreements for the exchange of environmental information.

(I 1.5)

Environmental barometer and Deutscher Umweltindex (DUX)

As already mentioned, effective environmental policies depend on broad public acceptance and support. Environmental protection must successfully compete against other social issues, such as the protection of old-age pensions. In particular, the need to simultaneously address economic, social and ecological interests as the key note of the concept of sustainable development calls for a clear-cut presentation of the ecological situation – in a manner that must be capable of keeping pace with the central indicators of economic life and social welfare.

The use of important key figures has long since been normal practice in Germany for describing economic and social developments. Examples include unemployment rates, inflation rates or the development of gross domestic product as an indicator for the wealth of society. The principle is always the same: individual indicators are used to represent a much more complex reality. These indicators are also a measure for the success of political action.

Up to now, there were no comparable parameters available to describe the situation of the environment. This is why the idea of an environmental barometer emerged in 1998 in order to represent the development of the environment by a few, however, representative indicators. By linking these indicators to political targets, deviations from the planned path and fields where action is needed can be identified.

The fields of climate, air, soil, water and the cross-section field of resources (energy/raw materials) are addressed by a total of six indicators; work on preparing a nature indicator is currently under way (table 1). It is still early days when it comes to the make-up of the environmental barometer and the definition of the contents of the individual indicators. Methodological progress and filling in the gaps that still exist in the data will contribute towards the future further development of the environmental barometer.

In co-operation with the Zweites Deutsches Fernsehen (ZDF) TV channel, the UBA has calculated a parameter for the first time in 2000 which reflects development trends in environmental protection in Germany in a single figure – the German Environment Index – (DUX). The DUX is based on the indicators of the environmental barometer. It is calculated on the basis of the relative fulfilment of the individual indicators for which the mean value is calculated.

Further details and the latest values of the indicators of the environmental barometer and DUX can be found on the Internet at www.umweltbundesamt.de/dux. *(I 1.1)*

UBA data on the Internet: umwelt deutschland, GEIN, Cleaner Production Germany

Certain offers on the UBA's website (www.umweltbundesamt.de), such as the database of substances constituting a hazard to waters or the ozone forecasts and maps published in summer, have become standard offers with a circle of regular users. But that's not all. As another offer on the Internet and on CD-ROM, umwelt deutschland (www.umwelt-deutschland.de) was developed for the EXPO 2000 world exhibition on behalf of the UBA and the Federal Ministry for the Environment (BMU) [14]. More than 600 individual multimedia contributions with audio, video and film elements offer an entertaining description of how our environment has developed, of the condition of landscape, fauna and flora, air, soil and water, and to which influences these are exposed. Furthermore, se-

Table 1: The indicators of the environmental barometer

Subject	*Key indicator*	*Target*
Climate	*Annual CO_2 emissions*	*25 % reduction in CO_2 emissions by 2005 in relation to 1990*
Air	*SO_2, NO_x, NH_3 and NMVOC emissions*	*Up to 70 % by 2010 in relation to 1990*
Soil	*Land consumption*	*Reducing the increase in land surfaces used for housing and traffic to 30 hectares per day by 2020*
Water	*Water quality class*	*Achieving chemical quality class II for all riverine waters by 2010*
Resources	*Energy productivity*	*Doubling energy productivity by 2020 in relation to 1990*
	Raw-material productivity	*Increasing raw-material productivity 2.5 times by 2020 in relation to 1993*

lected contributions provide an insight into future developments (Figure 4).

Figure 4: umwelt deutschland homepage

The individual subjects of umwelt deutschland can be accessed in several ways:

- by selecting the environment media, i.e. air, soil, water, or by selecting the nature & landscape area,

- at a sectoral level by selecting the areas of budget, traffic, industry and agriculture,

- by selecting focal issues, such as sustainable development, noise, climate, energy and others,

- via the "Regio-Navigator" which offers a compilation of regional environmental information, for example, on exemplary environmental projects by the federal states.

Users are free to decide which route they prefer in order to find their way through this wealth of information. The clear navigation structure offers a high degree of flexibility and clarity. A host of links between the different subjects turns the environment into a networked system. *(I 1.1)*

GEIN – the German Environmental Information Network – is the portal to environmental information. It combines a wide range of environmental information from some 60 sources in the federal government and federal states on the Internet which were formerly solely accessible via their individual websites with different access routes (Figure 5). GEIN offers all Internet users easy access for their searches at a single address, i.e. www.gein.de. Furthermore, GEIN enables users to select suitable search conditions via technical vocabulary, geographical names and an interactive environment calendar. The central research function offers access to a total of more than 80,000 websites, as well as eight linked databases with another 500,000 objects. On 2 June 2000, Federal Minister for the Environment, Jürgen Trittin, officially launched GEIN.

The UBA itself has connected its GEIN to six specialist and meta databases, i.e. ULIDAT, UFORDAT, UDK, GISU, IS-UPB, as well as a selection of 5,800 substances from the Joint Federal and States Substance Data Base (GSBL, page 178).

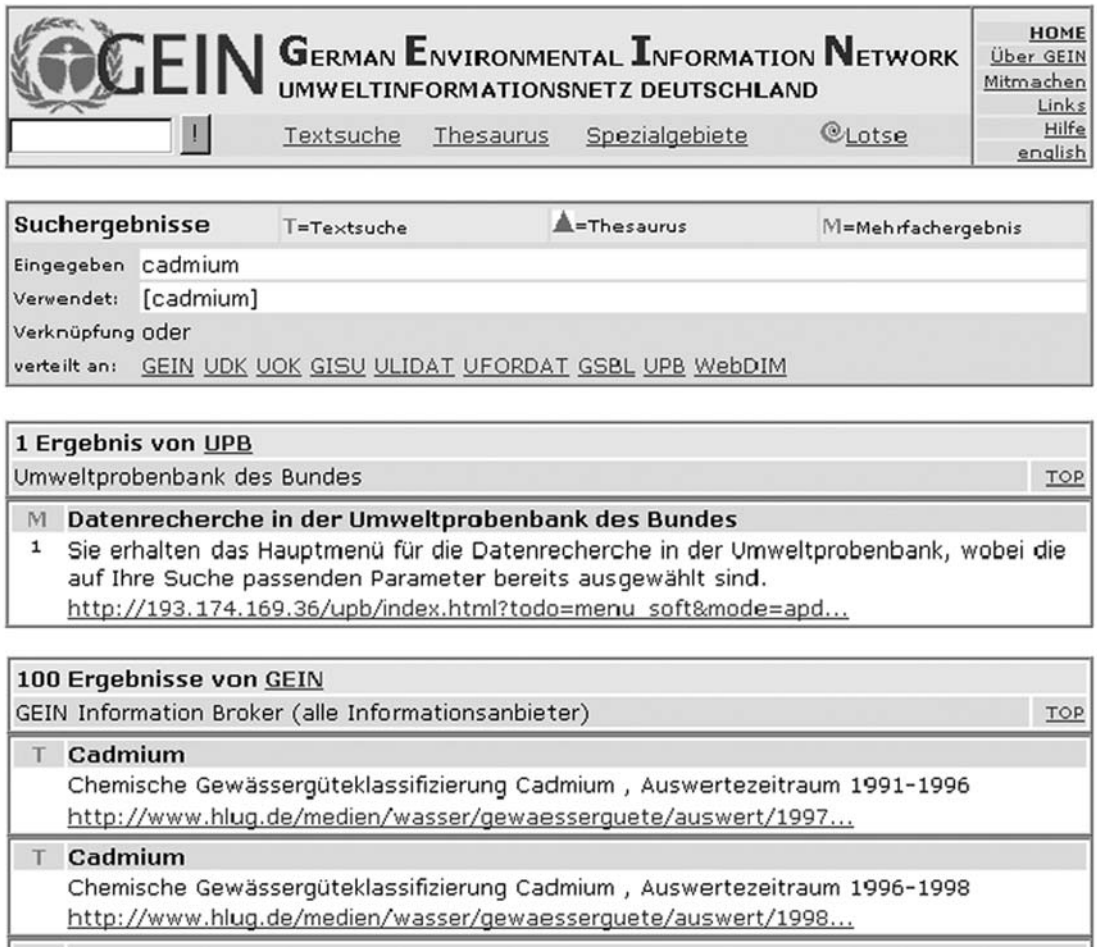
ULIDAT contains references to mostly German environmental literature from the following fields:

- air, water, soil,
- nature and landscape/development of landscapes,
- environmental aspects of agriculture and forestry/foodstuffs,
- waste,
- noise/vibration,
- environmental chemicals/pollutants,
- radiation,
- environmental aspects of energy and raw materials,
- environmental economics,
- ecology,
- environmental law,
- environmental policy,
- environmental education,
- environmental informatics and
- genetic engineering.

Some 400,000 quotes from magazines, series, reports, monographs, grey literature and Internet offers since 1976 are available. This database is growing by 30,000 references each year.

UFORDAT – the environment research database – is the federal government's central tool for co-ordinating environmental research. UFORDAT contains data on present and past research projects, as well as environmental research institutions in Germany, Austria and Switzerland. Around 65,000 research projects since 1974 are stored. In 2000 alone, another 3,000 projects were added. The data comes from

Figure 5: GEIN homepage



questionnaires sent each year to environmental research institutions, from the exchange of data with Organizations sponsoring research, such as the German Federal Ministry of Education and Research, German Federal Foundation for the Environment, the Swiss Federal Office for Environment, Forest and Landscape, Berne, the Austrian Federal Environmental Agency, Vienna, and increasingly directly from the Internet. Apart from access via GEIN, UFORDAT can be directly accessed on the Internet at isis.uba.de:3001.

UDK – the environmental data catalogue is a meta information system which was jointly developed by federal and state government. This catalogue provides information as to who has what environmental information and on what subject. In its environment data catalogue (UDK-UBA), the UBA documents its own environmentally relevant data, as well as data from other federal authorities and research institutions. The information in this catalogue is presented on the basis of uniform criteria which were jointly agreed to by the federal and state governments. Research in the federal and state governments' environmental data catalogues is possible on the Internet at www.umweltdatenkatalog.de.

GISU – the Geographical Information System for the Environment is the geographically orientated component of UBA's environmental information system. GISU can be accessed in test mode via GEIN on the Internet at www.gein.de. It offers navigation and research functions in the UBA's maps and enables access to geographical data. A cross-system interface with GEIN is integrated. The Geo-thesaurus Environment (GTU) was implemented in GISU. Its first version contains far more than 50,000 entries.

(Z 2.4, Z 2.5)

Data gathered during routine operation of the Environmental Specimen Bank (UPB, refer to Part 2, page 123) is compiled, edited and managed in the IS-UPB information system "Environmental Specimen Bank". The system has a modular structure and, besides basic elements – such as standard procedures and the key system – contains the data (analysis, biometric and anamnesis data) and its evaluation (research). A user-friendly research option (simple or advanced research) was recently added to the IS-UPB for use by all interested external users on the Internet. This function enables research to cover all the data of the Environmental Specimen Bank found via the routine program (with selection being possible in terms of sampling areas, specimen types, substances analysed and time horizons). The results are presented in both chart and graphic format. This research function, as well as any further relevant information about the Environmental Specimen Bank, can be accessed via the UPB homepage at 193.174.169.36/upb/index.html. *(II 1.4)*

Cleaner Production Germany, in contrast, is a separate Internet portal related to the transfer of environmental technology (www.cleaner-production.de). It offers a vast range of information concerning the efficiency of German environmental technology, as well as an overview of national and international subsidy instruments and contact partners in the field of technology transfer. The portal hence contributes towards the making of contacts between German and foreign actors in the field of environmental technology in order to launch co-operation projects and business relationships, and is hence not an one-way information street. What's more, Cleaner Production Germany is a well-founded source of information which is also available to representatives of German businesses and institutions abroad, as well as other multipliers when it comes to the demonstration and dissemination of German environmental know-how. *(III 1.1)*

Incentive for businesses: eco-audit with certificate

In preparation of the coming into effect of the Eco-Management and Audit Scheme (EMAS II) in spring 2001, a publicity campaign was launched in Germany at the end of 2000 in order to publicise this instrument of environmental policy which, although insufficiently familiar to the general public, was already successfully implemented by more than 2,500 German businesses. This concept is a successful joint initiative by the BMU (Federal Ministry for the Environment), the UBA, the German Federal Ministry of Economics, the federal states, the German business community and unions, as well as environmental associations. The UBA is in charge of implementing and co-ordinating the marketing campaign. The new EMAS logo, which is at the heart of this campaign (Figure 6), is awarded to businesses who do more for environmental production than they are obliged to by law.

- They meet with the demanding requirements of the EU's eco-management and audit scheme.
- They undergo regular audits by a certified environmental auditor.
- They lay down their internal environmental protection system in a public statement of environmental measures.

Based on a concept developed by the advertising agency Huth + Wenzel, Frankfurt/Main, the principles of EMAS II and the new EMAS logo will be introduced during the first phase of this marketing campaign, with different ads being published in primarily scientific magazines. *(I 2.2)*

Data for international reports

Thanks to environmental and sustainability reports by international institutions, the achievements of German environmental policy can be assessed in an international context. Within the European Union (EU), these reports are used as the basis for preparing and

Figure 6: the EMAS logo

supporting political programmes and measures and for monitoring their success. Diverging definitions and surveying methods in the individual member states are currently still limiting the comparability of much data. However, all the international institutions are working on the establishment and perfection of harmonised data bases for their environmental reporting systems.

The UBA sat in work groups of the Organization for Economic Co-operation and Development (OECD), the EU Statistical Office (Eurostat) and in the Environmental Information and Monitoring Network of the European Environment Agency (EEA) and hence took part in these activities. The UBA also co-ordinated the answers to the OECD/Eurostat joint questionnaire on the state of the environment in the member states, as well as the provision of the data base for the OECD's second environmental performance review for Germany, as well as the German co-operation in the environmental key indicator report by the EU Environment Directorate and in the EEA's second environmental indicator report. *(I 1.5)*

With its "decision to set up a European Pollutant Emission Register (EPER)", the European Commission has described the requirements for contents and make-up of the European Pollutant Emission Register (EPER) in more detail on the basis of the *EU Directive Concerning Integrated Pollution Prevention and Control (96/61/EC)*. Pursuant to this guideline, the member states undertake to report all the facilities covered by appendix I to this directive emitting one or more of 37 air or 26 water pollutants in excess of certain threshold values. These facilities, as well as their emission values, must be reported to the EU Commission in June 2003 for the first time for the 2001 reference year (or optionally for 2000 or 2002),

The legal implementation of this decision requires the amendment of *Federal Immission Control Act (BImSchG)* and of the *Recycling and Waste Act (KrW-/AbfG)*. 16 state ordinances must be passed in order to enable the flow of information to take place whenever immissions into waters and sewage treatment plants are concerned.

A national workshop was held on 17 October 2000 in Karlsruhe, Germany, in order to facilitate the technical implementation. The future exchange of information will be possible via www.eper.de.

The Aarhus Convention (see above, page 32) foresees the establishment of a pollutant release and transfer register (PRTR) by the signatory states. This register can be used to monitor environmental pollution via a structured, computerised and public database. First negotiations concerning structure, make-up and contents have already taken place. A proposal for a legally binding PRTR is to be submitted to the 5th Conference of Ministers "Environment for Europe" in Kiev, Ukraine (summer 2003). Germany's position in these negotiations is to base the "Aarhus PRTR" on the EPER in order to achieve the maximum level of harmonisation possible. *(II 3.2)*

[11] Free copies of the brochure "Umweltbewusstsein in Deutschland 2000" [Environmental awareness in Germany 2000] can be obtained via UBA's Central Answering Service (address: see page 94). It can also be found on the Internet at www.umweltbewusstsein.de.

[12] "Umweltberatung und Nachhaltigkeit. Dokumentation einer Tagung der Deutschen Bundesstiftung Umwelt in Osnabrück, 28./29.05.2000" [Environmental consultancy and sustainability. Documentation of a conference of German Federal Foundation for the Environment in Osnabrück, 28/29 May 2000] was published by Erich Schmidt Verlag, Berlin, and is available through bookstores.

[13] The printed version of "Daten zur Umwelt – Der Zustand der Umwelt in Deutschland" [Environmental data – the condition of the environment in Germany] (ISBN 3-503-05973-3) and the CD-ROM version (ISBN 3-503-05974-1) are published by Schmidt Verlag, Berlin, and are available through bookstores.

[14] Free copies of the CD-ROM "umwelt deutschland" [Environment Germany] can be obtained via the UBA's Central Answering Service (address: see page 94).

5. Employment through environmental protection

Overview

- Introduction
- Number of jobs in environmental protection exceeds the million mark
- The role of environmentally orientated services
- The working world in a sustainable economy
- Individual results of the scenario analyses
- Climate protection and jobs

Introduction

Environmental protection measures are influencing employment in many different ways. Employment in the production of environmental protection goods and the provision of services for environmental protection have a direct and positive influence on employment. This is supplemented by the indirect effects on employment among suppliers to manufacturers of environmental protection goods. The export of environmental protection goods can also protect existing jobs or create new ones at home.

Table 2: Jobs in environmental protection in 1998

Effects on employment due to	*Jobs (absolute figure)*
Production of environmental protection goods	***370,000***
• Investment due to environmental protection	*135,200*
• Expenditures due to environmental protection	*165,000*
• Foreign demand due to environmental protection	*69,800*
Assignment of staff with tasks in environmental protection, environmentally orientated services *(see table 2a)*	***906,500***
Job-promoting measures in environmental protection	***93,500***
Total (all gathered sections)	***1,370,000***

Sources: IFO (2001), Projektgemeinschaft IFO, DIW, ISI, Karlsruhe (2001)

Number of jobs in environmental protection exceeds the million mark

According to a survey carried out in 1996 on behalf of Federal Environmental Agency (UBA) [15] almost one million jobs were already dependent on environmental protection in 1994. This result is impressive because this is rather the lower limit due to the problems of gathering such data and the restrictive definition of the environmental protection market adopted for the purposes of this survey.

In order to gain an insight into the latest figures on employment in environmental protection, a research project was launched in 2000 on behalf of the UBA under the leadership of IFO Institut für Wirtschaftsforschung, Munich. First results gained in this project indicate

- that emplyoment due to the production of environmental protection goods is still at a high level and
- that the trend towards an increase in services demanded by environmental protection continues.

According to conservative estimates, it can be assumed that in 1998 in Germany at least 1.3 million jobs will depend on environmental protection (Table 2). Taking the 1998 total working population of 37.5 million in Germany, this is as much as around 3.6 % of the total workforce. This means that more people were employed in environmental protection than, for example, in mechanical engineering, in the automotive industry or even in the food industry. The overall effect on employment recorded for 1998 is considerably higher than that recorded by the economic research institutes in their survey for 1994. This is primarily due to a expanded demarcation of the environmental protection sector (refer to page 44) and new or improved data. One example is the trade sector where, apart from the wholesale trade with used material and waste, jobs in the trading of environmentally friendly goods and in car-related sectors were also included. Although new employment fields were included in the figures, the estimate of 1.3 mil-

lion jobs in environmental protection still represents the lower limit for the actual effect on employment.

For example, the effects on employment resulting from integrated environmental protection measures (refer to chapter 6) are only partially included or even not at all. This also applies to investments in renewable forms of energy or efficient forms of energy use.

The role of environmentally orientated services

In all developed economies, services have meanwhile become the engine of growth and employment. The services sectors have also grown rapidly in Germany in recent years. In 1998, 63 % of the total working population was already employed in the services industries. More recent studies on the supplier situation in the environmental protection sector indicate that the importance of services is also growing in environmental protection.

Against this background, the IFO institute already referred to has prepared a survey on behalf of the UBA on "Umweltorientierte Dienstleistungen als wachsender Beschäftigungssektor"[Environmentally orientated services as a growing employment sector]. [16] The authors examined:

- how environmentally orientated services can be defined and distinguished from other services,
- how important environmentally orientated services as a whole are for the labour market,
- just how important these servcies are currently considered to be in the different economic sectors.

Based on this information, the researchers have worked out job-promotion and job-restricting factors, estimated the potential for employment in certain sub-sectors and have identified starting points for promoting environmentally orientated services. The survey also contains in-depth case studies.

In order to distinguish environmentally orientated services, a broad definition of environmental protec-

Table 2a: Environmentally orientated services in 1998 broken down in areas

Environmentally orientated services sectors	*Jobs (absolute figure)*	*Jobs (calculated as full-time jobs)*
Agriculture and forestry	***55,700***	***48,500***
Producing industries	***253,900***	***244,900***
• *Mining and processing industries*	*144,000*	*137,300*
• *Energy and water supply*	*41,900*	*40,700*
• *Construction industry*	*68,000*	*66,900*
Trade, hotels & restaurants, transport	***166,500***	***149,000***
• *Trade, maintenance and repair of vehicles and consumables*	*86,000*	*75,000*
• *Hotels and restaurants*	*5,000*	*4,200*
• *Transport/communications*	*75,500*	*69,800*
Property and real-estate sector, financing, leasing, services for businesses	***168,800***	***139,600***
Public and other private services	***261,600***	***238,500***
• *Public administration*	*59,800*	*55,400*
• *Education and training, interest groups in environmental protection*	*34,500*	*29,800*
• *Disposal services*	*167,300*	*153,300*
Total	***906,500***	***820,500***

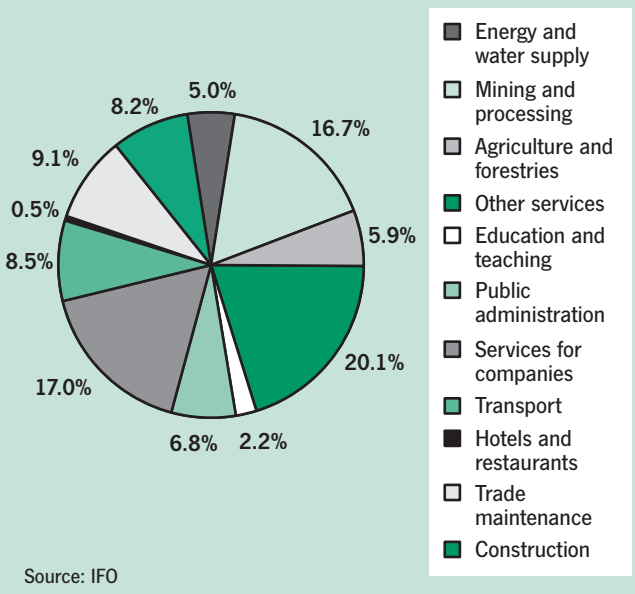
Source: IFO-Institut (2001)

tion is used that is based on the guidelines issued by the Organization for Economic Co-operation and Development (OECD) and by Eurostat. Apart from traditional services in environmental protection, so-called "new" environmentally orientated services that have become more predominant in recent years are also taken into consideration for the first time. These include energy and building management, "new" mobility services, such as car-sharing, environmentally orientated finance and insurance services, as well as eco-tourism. This means that the survey offers what is up to now the most comprehensive overview of environmentally orientated services in Germany.

According to the results of the survey, at least 906,500 people were employed in the field of environmentally orientated services in 1998 (Table 2a). For various reasons, this figure must be seen as a lower limit. For example, it was not possible to gain quantifiable data for certain fields of examination due to a lack of data or unreliable data. These fields include environmentally orientated insurance services, sub-sectors of the "new" mobility services and the entire field of "eco-tourism".

Environmentally orientated services are being provided in all branches of the German economy. This means that they can be found not just in the so-called services sector, but increasingly in areas that, based on the conventions of official statistics, are assigned to the producing industries or to agriculture and forestry (Figure 7). In 1998, more than two thirds of the workforce in environmentally orientated services were employed in the private sector in 1998, around a quarter in the public sector, including state-owned companies, and around two percent in non-commercial Organizations.

Figure 7: Employment in environmentally orientated services broken down in sectors



Source: IFO

Forecasts for future developments in employment indicate that environmentally orientated services in general – and in this case, in particular, knowledge-based services such as energy consultancy – will continue to gain in importance. Prospects for short-term developments in employment, as were polled within the scope of the IFO survey among suppliers of environmental protection, appear to be promising throughout. Particularly high growth rates are expected by companies offering financial services, followed by maintenance and repair businesses, as well as the waste management industry. However, in some service sectors – for example, among civil servants involved in environmental protection tasks – the level of employment is expected to decline or at least stagnate.

This positive overall development can be explained by a number of factors, including the general trend towards a service society, the growing importance of services in individual sectors (R&D, customer service, etc.) as well as growing awareness of environmental matters (refer to chapter 4). In industry-related services, outsourcing, i.e. the removal of activities from the company that do not belong to its core expertise, is at times of considerable importance.

And last but not least, environmental policy is also creating an important impetus for new jobs. There is a vast range of possibilities open to the government for boosting employment in environmentally orientated services through a change in the framework conditions. State subsidies, for example, for insulating buildings, also form part of this as much as tax legislation. Regulatory measures play an equally important role: for example, it can be expected that the EU End-of-Life-Vehicle Directive will in the medium term have a considerably positive impact on employment because starting in 2006, car manufacturers will be obliged to take back all old vehicles free of charge, thus stimulating demand for disposal services.

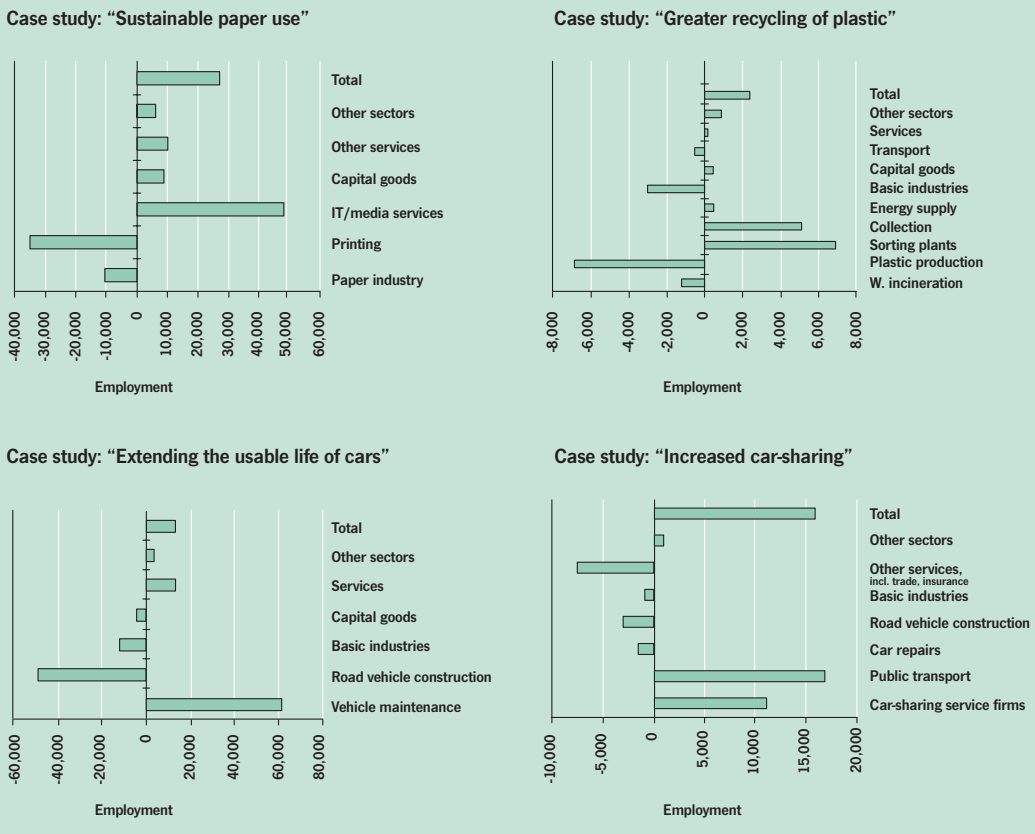
The fields of environmentally orientated services that are experiencing particularly dynamic growth include the field of contracting/heat-supply services. The number of jobs will presumably more than double between 1998 and 2005, from 21,000 to 45,000. This development is due to several factors: the trend towards outsourcing activities that are not part of a company's core expertise, the greater scope of activity as a result of the liberalization of the energy market and the increase in energy prices due to the ecological tax reform campaign.

The working world in a sustainable economy

The ecological modernisation of business and society is a must in order to achieve sustainable development. The profound changes required in our economy raise the question as to the long-term effects which an environmental policy based on the concept of sustainability can bring with it. What are the consequences of such a policy for the working world? Can jobs be created or maintained through ecological modernisation? Which demands will be placed in future on producers and employees? These questions have been taken up by an UBA survey that is being carried out by the Fraunhofer-Institut für Systemtechnik und Innovationsforschung (ISI), in Karlsruhe. This survey examines on an exemplary basis ecological modernization strategies using case studies from the fields of recycling, environmentally friendly production methods and environmentally friendly production concepts. [17]

Sustainability scenarios were developed for individual case studies (Figure 8), enabling the medium and long-term analysis of the economic, ecological and social effects of modernisation strategies with an environmental protection character. Similar to an assessment of the consequences of technology, the scenarios do not claim to forecast the future. Howev-

Figure 8: Net effect on employment due to ecological modernization strategies



er, they do offer an insight into which development path can be adopted under certain conditions and help to identify the synergetic effects of environmental and employment policies.

The results can be summed up as follows:

- Ecological modernization strategies are boosting the trend towards a service society.
- All the sustainability scenarious developed within the scope of the survey lead to greater employment. This confirms the theory that ecological modernization does not generally clash with employment goals, but that they pay off both in the medium and long term and with a view to employment.
- Although the net positive effect on employment is moderate, a considerable shift does take place between the different sectors. This means that there are both winners and losers in ecological modernization.
- Compared to the "loser sectors", the "winner sectors" usually have a smaller import share and a greater labour component. This is one of the primary reasons behind the positive net effect on employment.
- Ecological modernization and the structural change triggered thereby has considerable repercussions on the qualifications required of employees. General statements, however, are not possible in this context.

Individual results of the scenario analyses

In the case study: "Sustainable paper use", the level of employment increases, above all, in multi-media and IT-related sectors, whilst a decline is seen in the paper industry and in the traditional printing sector. Due to this shift, the demand for workers with higher qualifications increases, in particular, with third-degree education. Work contents, such as software development, website design and consultancy services are particularly important in the new IT and media-orientated services.

Contrary effects on employment can also be seen in the "Plastic recycling" case study. Greater plastic recycling leads to falling employment figures in the basic industries and in the production of plastics, whilst an increase in figures can be expected in the collection, sorting and processing of plastics. Above all, the trend towards greater automation in the sorting sector is responsible here for the comparatively low net positive effect. The bottom line is that a growing demand for employees with low qualifications can be expected, particularly in sorting plants where an increase in shift work is expected.

The positive effect on employment in the case study "Extending the usable life of cars" is owed to the fact that the considerable decline in vehicle production is overcompensated by the increase in the vehicle repair sector. On the whole, the demand for workers with low to medium qualifications increases whilst the demand for employees with technical and third-degree qualifications declines.

In the case study "Intensifying the use of products through car-sharing", car-sharing service companies and public transport are the winners whilst the greatest job losses focus on road vehicle construction and other services. All in all, a trend towards higher qualification levels can be expected. Above-average demands are being placed, however, on increasing flexitime. *(I 2.2)*

Climate protection and jobs

How does climate protection affect the labour market? This question was the key issue in the research project "Arbeitsplätze durch Klimaschutz" (Jobs through climate protection) [18]. The UBA commissioned Prognos AG, Basel, to carry out this project. The authors selected a two-stage approach for identifying the effect on employment. This approach involves combining

- a bottom-up approach for calculating the direct effects on employment caused by climate protection mesaures and
- an input/ouput model for assessing the indirect effects.

Calculating the direct effect on employment was linked directly to climate-protection technology and measures. The central question was: taking productivity trends into consideration, how many workers are needed in order to produce, install and service a certain climate-protection system, for example, solar collectors? And vice versa, the question was also posed as to how many workers would no longer be required in the field of conventional technologies. The bottom line – more demand and less demand for workers – results in the net direct effect on employ-

ment for the respective climate-protection measures and technologies.

The bottom-up approach is restricted solely to the direct effects on employment which, however, only represent part of the overall effects. Based on the aforementioned example, it becomes clear that due to an increase in demand for solar collectors, positive effects on employment are to be expected, not just in mechanical engineering, but also in the glass producing sector, for example, since high-quality glass products are used to build solar collectors and will hence be in demand. These indirect effects are calculated using an input/output model.

The input/output model takes the previously calculated direct effect on employment and applies this to the other sectors of the economy under survey. These calculations are based on empirical input/output tables for Germany which are extrapolated in view of employment intensity for the period under survey. In this manner, the effect on employment can also be calculated for sectors that are only indirectly affected by a climate-protection policy.

The results that were calculated on the basis of the aforementioned preconditions can be summarized as follows:

- On the whole, a substantial positive employment effect can be seen in the different scenarios examined with regard to the reduction of environmentally harmful carbon dioxide (CO_2) emissions. For example, Prognos expects far more than 100,000 new jobs, depending on the particular CO_2 reduction aim which is adopted.
- A particularly strong impact on employment is expected in the building, mechanical engineering and transport sectors, whereby the greatest effect is presumed to be in the building sector. These forecasts are the result of two developments: first of all, a growing demand for thermal insulation is expected and secondly, a greater demand for infrastructure measures in the public transport and rails sectors.

The results show that climate protection objectives can be implemented without having to accept employment losses. In fact, a considerable increase in jobs is to be expected.

(I 2.5)

[15] The survey "Aktualisierte Berechnung der umweltschutzinduzierten Beschäftigung in Deutschland" [Updated calculation of employment induced by environmental protection in Germany] was published in 1996 in the BMU (Federal Ministry for the Environment) series on environmental policy.

[16] The survey "Umweltorientierte Dienstleistungen als wachsender Beschäftigungssektor" [Environmentally orientated services as a growing employment sector] will be published in UBA's BERICHTE series by Erich Schmidt Verlag, Berlin, and will be available through bookstores.

[17] The survey "Arbeitswelt in einer nachhaltigen Wirtschaft" [Working world in a sustainable economy] will be published in UBA's TEXTE series, and will be available from Werbung + Vertrieb (address on page 94).

[18] Prognos AG (editors): "Arbeitsplätze durch Klimaschutz – sind klimaschützende Maßnahmen ein sinnvoller Beitrag zur Arbeitsmarktpolitik?" [Jobs through climate protection – are climate protection measures a sensible contribution towards labour-market policies] will be published by Peter Lang, Essen, and will be available at bookstores.

6. Integrated product policy and sustainable consumption

Overview

- Introduction
- Integrated product policy: environmentally compatible definition of life cycles
- Sustainable consumption – demand is vital
- Demonstration project for sustainable consumption
- Consumer protection at an international level
- The Eco-label: product-related environmental protection

Introduction

In order to achieve sustainable development, it is becoming more and more important to assess the environmental implications related to the **LIFE CYCLE PHASES** of a product. Particularly in the European Union (EU), environmental politicians both in the member states and within the European Union are hence increasingly developing an integrated approach which addresses the entire life span, from the manufacture to disposal. To this effect, the European Commission presented the draft *Green Paper on the Contribution of Product-Related Environmental Policy to Sustainable Development – A Strategy for an Integrated Product Policy Approach in the European Union* in February 2001. This document sets forth the further development of the principles agreed to during the informal meeting of EU environment ministers in Weimar in 1999. The concept which is also important for the work of the Federal Environmental Agency (UBA) is called the "Integrated Product Policy" (IPP).

Life cycle phases: *The individual phases of the product life cycle, such as manufacture, use, disposal.*

Environment management system: *This provides organizations a clear-cut picture of their environmental impact and assists them in focusing on and mastering the most important ones.*

Integrated product policy: environmentally compatible definition of life cycles

The aim pursued by this concept is to reduce environmental effects of products throughout their entire life cycles, to develop more environment-friendly products and to improve their marketing prospects. This effort is to include all the groups involved, such as producers, retailers, consumers, non-governmental organizations (NGOs), as well as public authorities. Different instruments are to be combined within the scope of an integration concept, where the price mechanism and the strengthening of demand for environment-friendly products, as well as standards and product guidelines deserve special mention. Furthermore, instruments which are not directly product-related also play an important role.

- Product prices should reflect their real environmental cost throughout their entire life cycles. This can be achieved by including external costs in the product price in order to induce producers to increasingly develop and market environmentally compatible products, i.e. to generate a supply.
- Demand for products of this type is to be strengthened and user attitudes are to be influenced. This approach is designed to address not just the public sector as a model for customers, but also private consumers. This can, for instance, be achieved through official instruments, such as the sourcing guidelines by the European Commission. Private instruments, such as Eco-labels and information campaigns, also play a role in addition to these regulatory instruments.

Different methods and tools are being proposed for developing environmentally friendly products and for supporting innovative businesses in this field. Besides the introduction of **ENVIRONMENT MANAGEMENT SYSTEMS**, The EcoDesign method should be mentioned here.

The term EcoDesign reflects the notion that ecology and economy are to be merged by a sound design. A

guide [19] shows how this can be done. This manual is the result of a three-year research project on "Möglichkeiten einer umweltgerechten Produktgestaltung im Bereich der Normung" [Opportunities of environmentally compatible product design in the field of standardization] carried out on behalf of the Federal Ministry for the Environment (BMU) and the UBA. The results are also passed on to the standardization project for developing *guidelines to integrating environmental aspects into product development* carried out by the International Standardization Organization (ISO).

The basic idea: once properly under way, it pays off to consider environmental aspects from the very beginning of the product planning, development and design process. Ecological thinking can, so-to-speak, become an engine of innovation and help save costs and win market shares.

A technical report on ecological product design (ISO/TR 14062) is to be developed at ISO, offering product developers world-wide an orientation and communication framework.

The new working group WG 3 at the technical "environment management" committee (ISO/TC 207/WG 3) was established for this purpose. On the basis of a resolution by the Normenausschuss Grundlagen des Umweltschutzes (NAGUS) at the Deutsches Institut für Normung (DIN), the NAGUS working committee 1 "Environmental aspects in product development" was established as a "national mirror body".

Environmental aspects are also to be systematically considered in European product standards, and environmental guidelines are to be set up for the development of standards. The Environmental Help Desk of the European Committee for Standardization (CEN-EHD) is to continue operating with additional responsibilities. It supports committees and work groups developing standards at a European level by addressing environmental issues in their work. Topical information about this can be found on the Internet at www.cenorm.be/sectors/ehd.

Sustainable consumption – demand is vital

Promoting sustainable consumption attitudes is an important task of environmental policy. This became clear at the 1992 Conference on Development and the Environment (refer to chapter 3). Agenda 21 points out that the protection of environmental resources will be one of the central challenges of the 21st century. A host of programmes and measures has since been launched at international and national level in order to make sustainable consumption a natural element of life.

In order to make integrated product policy a success, consumers must buy ecologically optimised goods and services. The promotion and propagation of sustainable consumption patterns are hence also important tasks of environmental education, consulting, and communication strategies. One of the major problems is that the issue is so far widely unknown among the general public. How can this be changed?

In co-operation with the German Environmental Management Association (BAUM), the UBA held a workshop on 15 and 16 February 2000 in Berlin on "Sustainable consumption patterns – ways of environmental communication" which was attended by more than 160 representatives from the business community, public administration, as well as environmental and consumer groups. The conference was to open up ways to develop joint campaigns in important environmental areas, such as

- washing and cleaning
- regional products
- energy-saving in private homes and
- mobility.

The results of the workshop are documented on the Internet at www.baumev.de.

One concrete example of such a campaign: together with the Karstadt Warenhaus AG department store chain, Essen, and Bund für Umwelt und Naturschutz Deutschland (BUND), the UBA approached the general public with the "ecological school start". The start took place on 27 March 2000 at the "elementary school in the green" in Berlin's Hohenschönhausen district. This campaign not only attracted large and mostly positive interest by the media, but was also successful in reversing the formerly declining trend towards the use of environmentally friendly stationery and office supplies. The final report by Karstadt Warenhaus AG states that sales of environmentally friendly school articles had doubled in 2000 compared to the previous year. *(I 2.2)*

Another example of how important co-operation between different parts of society is for the firm establishment of this subject in society and the general public is the conference "Aktiv für die Zukunft – Wege zum nachhaltigen Konsum" [Active for the future – ways towards sustainable consumption] that was sponsored by the UBA and held by Evangelische Akademie Tutzing from 3 to 5 April 2000. This conference is a central element of a national discussion process launched as early as during the mid-1990s by the Federal Ministry for the Environment and the UBA in order to promote sustainable consumption. A document titled "Förderung des nachhaltigen Konsums – Prozess der nationalen Verständigung" [Promoting sustainable consumption – the process of national discussion] [20] formed the foundation for this process. 18 associations supported the "Tutzing principles" laid down in this document for promoting sustainable consumption (see box below). Chapter 4 addresses the subject of "environmental communication" in detail. *(III 1.3)*

Demonstration project for sustainable consumption

Within the scope of the Environmental Research Plan (UFOPLAN) by the Federal Ministry for the Environment, the UBA has launched a number of projects on the subject of sustainable consumption. The milestone for the year 2000 is the successful completion of the "demonstration project for supporting and evaluating sustainable consumption patterns and behaviour". The demonstration project is split up into four sub-projects:

- Sub-project 1: Instruments and strategies for promoting sustainable consumption – evaluation and optimisation (Institut für ökologische Wirtschaftsforschung, Berlin)
- Sub-project 2: Exploration of the conditions, possibilities and limits of sustainable consumption in private homes (Institut für sozial-ökologische Forschung, Frankfurt)
- Sub-project 3: Priorities, trends and indicators of environmentally relevant consumption patterns (Wuppertal Institut für Klima, Umwelt, Energie, Wuppertal)
- Sub-project 4: Understanding between the parties involved concerning the principles and steps for promoting sustainable consumption patterns (Institut für angewandte Verbraucherforschung, Köln).

Each of these sub-projects pursued specific aspects of the "sustainable consumption" issue.

The result of sub-project 1 indicates that the mix of regulatory, economic and information instruments so far adopted yielded partly substantial efficiency gains in the fields of washing and heating. However, the general trend in society towards increasing purchases of consumer goods by private households has not been influenced. Success was also observed in the field of product-related consumer advice and marketing promotion. The promotion of broad-based co-operation between the players was found to be an effective means of influencing sustainable consumption behaviour.

Based on a general description of selected consumption trends in recent years, sub-project 2 embarked on a social approach for an in-depth analysis of day-to-day consumption models and the concrete consumption behaviour of 105 selected households in order to describe consumption styles in the form of a typology. Proposals for developing new, target-group- and consumption-style-specific "ecologization strategies" for private consumption had to be developed on this basis. The survey differentiates between four target groups for ecologization strategies:

- Target group 1: The environmentally orientated
- Target group 2: The overpowered
- Target group 3: The traditionalists
- Target group 4: The privileged

The authors of the study conclude that many groups of society have substantial reservations concerning

The Tutzing principles

The issue of "sustainable consumption" is a central element of sustainable development.
Individual responsibility of all players in society is vital for promoting sustainable consumption.
The plurality of lifestyles is the basis for developing differentiated strategies for action.
The conditions for acting in the interest of sustainable consumption are to be improved and options for acting are to be promoted.
Different instruments are to be developed in order to promote sustainable consumption.
The national discussion process is to be continued and intensified.

the "eco-issue". On the other hand, the sustainability model can be generally used as a starting point, in particular, with a view to the responsibility towards future generations and against the background of increasing health orientation.

Sub-project 3 of the demonstration project took a closer look at the areas in which private households had ecologically significant practical options. The main issue was to identify indicators and key resources capable of permitting the reliable mapping of environmental consumption through private consumption in various fields of demand. With regard to energy and material consumption, the survey identifies the fields of construction and living, food and mobility as predominant areas of demand.

The aim of sub-project 4 was to strategically establish this issue among the different players in society and to document to what extent this issue was addressed by associations and social interest groups. The results of this sub-project were the basis of and precondition for the national discussion process for promoting sustainable consumption, i.e. the aforementioned Tutzing conference. *(III 1.3)*

Consumer protection at an international level

International consumer protection work is an important focus of UBA's subsidy and promotion programmes. From 1996 to 2000, the UBA supported the German contribution to the co-operation project "Internationale Maßnahmen zur infrastrukturellen Unterstützung der Verbraucherarbeit zur Förderung des nachhaltigen Konsums" [International measures for the infrastructural support of consumer work for promoting sustainable consumption] of Consumers International (CI), the international federation of consumer organizations. The funds were paid to the Cologne-based Institute of Applied Consumer Research (IFAV).

The aim of the entire project was to arouse and support consumer awareness for environmentally relevant consumer decisions in the countries represented by the CI member organizations. One particular aspect was the importance of environment-related statements in advertising and on products. The results of this work included a leaflet and a brochure with easy-to-understand information about ISO 14021 (environmental labelling and declarations, type II) and practical examples for implementation.

The results were presented at the 16th CI world congress from 13 to 17 November 2000 in Durban, South Africa.

Publications and practically orientated guides are available on the Internet at www.consumersinternational.org.

The Eco-label: product-related environmental information

The "Blue Angel" is one of the most popular symbols for identifying environmentally friendly products. It is thus an important element of product-related consumer information (concerning new product groups of the "Blue Angel", please refer to part 2, pages 150 and following). Its European counterpart is "The Flower" (Figure 9).

The *EU Regulation on a revised Community eco-label award scheme (1980/2000/EC)* of 17 July 2000 has now created the basis for boosting the efficiency of the European Eco-label.

Figure 9: the European Eco-label

The Eco-label is a voluntary instrument for product-related consumer information. It is an important orientation aid for consumers throughout Europe. Unlike the "Blue Angel", "The Flower" is so far little known in Germany. This is in part due to the fact that German companies are not yet using the European Eco-label in their marketing activities. This is different in other EU member states, for example, in the Scandinavian countries.

At present, "The Flower" can be applied for 15 product groups; around 65 companies in Europe have already applied for this by the end of 2000. The trend is increasing, in particular, in the paints and varnishes, as well as textiles product groups. According to the European Commission, another ten to fifteen product groups are to be added to the European Eco-label system by 2004. Besides furniture and floor coverings, tyres, TV sets, vacuum cleaners, surface and sanitary cleaning agents, as well as travel products will be eligible in the future. Member states will presumably decide on further product groups in autumn 2001.

Up-to-date information about the European Eco-label is available on the Internet at www.europa.eu.int/eco-label.

[19] ""How to do EcoDesign?" A Guide for environmentally sound Design (ISBN 3-89802-025-8), is available through bookstores.

[20] The complete documentation "Tagung Aktiv in die Zukunft – Wege zum nachhaltigen Konsum" [Active for the future – ways towards sustainable consumption] will be published in the UBA's text series, and will be available from Werbung + Vertrieb (address: see page 94).

7. New ways for climate protection

Overview

- Introduction
- Reducing greenhouse gases through energy efficiency
- CO_2 reduction in road traffic
- Additional measures for reducing CO_2 in road traffic
- Sulphur hexafluoride & Co.: the underrated greenhouse gases
- Methane and dinitrogen oxide

Introduction

Since 1860, the global increase in air temperature has averaged around 0.6 °C. The warming observed in the northern hemisphere during the 20th century is the strongest in the past 1,000 years. 1990 to 1999 was so far the warmest decade, with seven of the ten warmest years world-wide taking place after 1989. The year 1998 was the warmest since systematic temperature measuring programmes started around 1860. The 3rd assessment report carried out by the Intergovernmental Panel on Climate Change (IPCC), which was published in spring 2001, increasingly blames anthropogenic causes for this warming trend which is also referred to as the **GREENHOUSE EFFECT**.

Both a comparison of field data to model simulation and statistical evaluations of long temperature series indicate that anthropogenic factors have substantially contributed towards the climatic change that has taken place over the past 35 to 50 years. Climatic change has, for instance, already led to the retreat of glaciers and behavioural changes among wild animals. Permanently frozen soils (permafrost) are thawing, vegetation periods are becoming longer.

Given an unchanged increase in greenhouse gas concentrations, model calculations suggest an average global temperature increase of 1.5 to 6 °C. Although forecasts expect precipitation to increase on average, this will happen in a regionally differentiated manner. It is very likely that arid and semi-arid areas will become even drier which will increase the existing water deficit even further. This, again, will have negative implications for agricultural and forestry production, natural ecosystems and human health. Extreme events – such as heat waves, drought and extreme precipitation – must be expected with further consequences, such as harvest losses (up to 30 % in some regions) forest and steppe fires, floods and increased sickness rates due to heat stress and infectious diseases.

The warming-induced expansion of oceans and the melting of glaciers will cause an average swelling of the sea level by around half a metre by the year 2100, resulting in the loss of land and assets, expulsion of several tens of millions of people, increased risk of high storm waters, salinisation of fresh-water reserves and endangering of coastal wetlands.

Greenhouse effect: *Various gases – including carbon dioxide (CO_2), dinitrogen oxide (N_2O), methane (CH_4), ozone (O_3) and chlorofluorohydrocarbons (CFCs) – are transparent and colourless and hence permit visible light (short-wave sun radiation) to pass without any resistance. They are, however, capable of absorbing long-wave heat radiation in certain wavelength bands. The presence of gases with a greenhouse effect restrains the heat radiation by the earth: the temperature rises. Man also releases greenhouse gases into the atmosphere causing an additional – anthropogenic – greenhouse effect.*

Kyoto Protocol: *This protocol supplements and extends the United Nations Framework Convention on Climate Change and defines in detail the provisions for climate protection. One crucial requirement obligates industrialized nations to reduce their greenhouse emissions by a total of 5.2 % on a differentiated scale for the different countries. These reductions do not necessarily have to be achieved by measures in the countries themselves, but may also be ensured on a pro-rata basis via projects in other industrialized nations (joint Implementation) or developing countries (clean developing mechanism), and via trading with emission certificates (emission trading).*

If mankind is to stop the foreseeable development of the climate, determined action is necessary for the protection of the climate. The setbacks in the international negotiation process do not eliminate the need for action in order to achieve a global reduction in the emission of climate-damaging greenhouse gases. *(II 6.2)*

Reducing greenhouse gases through energy efficiency

The United Nations Conference on Development and the Environment in 1992 in Rio de Janeiro (refer to chapter 3) triggered a world-wide drive for climate protection which led to the definition of binding aims for reducing greenhouse gases, i.e. carbon dioxide (CO_2), methane (CH_4), dinitrogen oxide (N_2O) and fluorinated gases (chlorofluorohydrocarbons – HFHC, FHC – and sulphur hexafluoride, SF_6) with the third conference of the parties to the United Nations Framework Convention on Climate Change in 1997 and the **KYOTO PROTOCOL** (page 53; on the Sixth Session of the UNFCCC Conference of the Parties in The Hague, see box on page 56). The European Union (EU) has committed itself to an 8 % reduction (compared to 1990) in greenhouse gases by the period 2008 to 2012. Within the framework of a distribution of burdens within the EU, Germany has pledged to reduce its greenhouse gas emissions by 21 %. This corresponds to three quarters of the reduction of greenhouse gas emissions attributable to the EU. Furthermore, Germany will continue to pursue its national climate protection aim which foresees a 25 % reduction in CO_2 emissions by 2005 as against 1990.

Greenhouse gas emissions in Germany were in total substantially reduced compared to 1990 (Figure 10). Total emissions converted to CO_2 equivalents fell by almost 19 % between 1990 and 1999. Without further climate protection measures, there is, however, a likelihood that emissions will increase again.

Carbon dioxide has the greatest impact on the climate due to the large volumes of this gas that are emitted. In Germany, the combustion of fossil fuels – such as coal, oil and gas – accounts for around 97 % of these emissions. Most of the reduction in CO_2 emissions took place during the first half of the 1990s as a result of the structural change in the economy in the new east German federal states. It was accompanied by an increase in energy efficiency, replacement by energy sources with lower emission levels and the shutting down of obsolete plants. According to calculations performed by Arbeitsgemeinschaft Energiebilanzen [Energy Balances Study Group] on the basis of preliminary data, emissions in 1999 were 15.4 % lower than in 1990. Around 60 % of the German CO_2 reduction aim was thus achieved. No further CO_2 reduction was achieved between 1999 and 2000; emissions in 2000 were 0.2 % higher than in 1999.

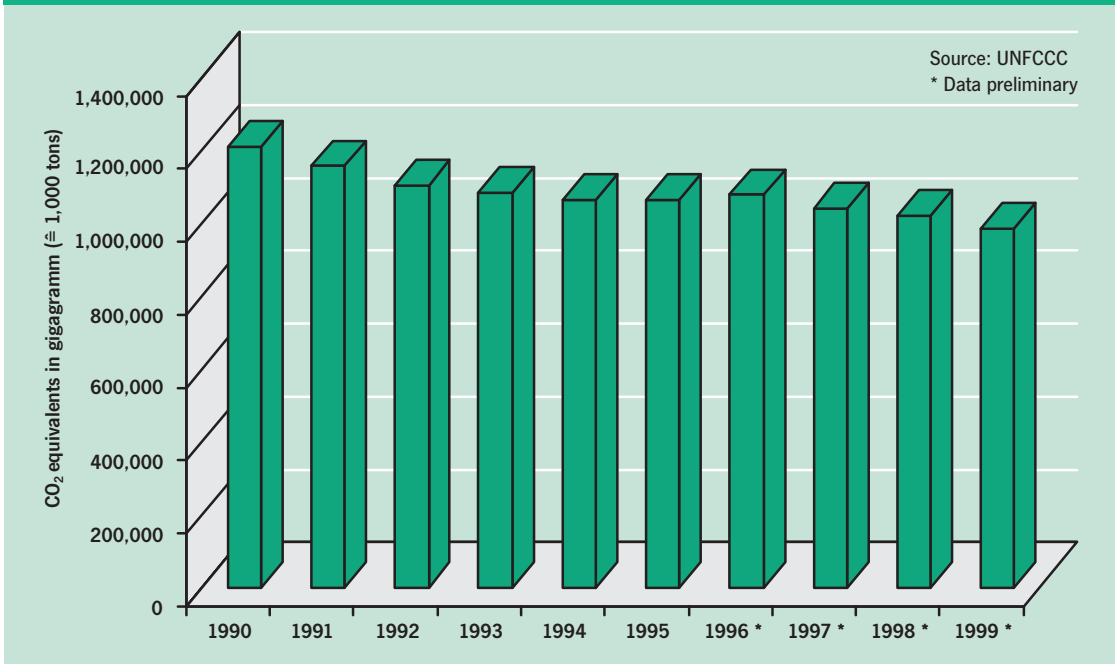
Further steps that were recently taken will lead to a further reduction of CO_2 emissions and, more specifically, of CO_2 emissions caused by energy consumption:

- The ecological tax reform with gradually rising energy prices for fuels and electricity as an incentive for the development and market introduction of new technologies, as well as for energy-saving attitudes.
- The *Renewable Energy Sources Act (EEC)* that promotes the generation of electricity from renewable sources, such as sun, wind and water.
- The market introduction programme for renewable energy sources which will, in particular, benefit the use of solar collectors and energy-saving attitudes.
- The "100,000-roofs programme" that supports investment in photo-voltaic installations.
- The building rehabilitation programme by Kreditanstalt für Wiederaufbau (KfW).
- The promotion of low-sulphur and sulphur-free fuels which will additionally prepare the breakthrough of low-consumption and lower-emission engine technologies.

Although the emission reductions so far achieved mean that the greater part of the climate protection targets set for 2005 or 2008 to 2012 (Figure 10) has already been reached, further action is necessary in order to achieve the climate protection targets. To this end, on 18 October 2000 the federal government decided to implement a national climate protection programme. This programme is, amongst other things, based on research projects by the Federal Environmental Agency (UBA), including the "Scenarios for Climate Protection" and "Emissions and reduction potential for HFHC, FHC and SF_6 in Germany" projects. The following concrete measures are foreseen:

- **In the power sector:** Expanding combined heat and power generation (CHP) as a technolo-

Figure 10: Emissions of greenhouse gases in Germany



gy that enables much more effective use of energy sources by cogeneration.

- **In the construction sector:** Measures in this sector include the *Energy Saving Ordinance* that aims at reducing the energy demand in new buildings compared to former standards by around 30 %. Furthermore, this ordinance contains an obligation to upgrade existing buildings and provisions for more far-reaching and more restrictive requirements for building modifications.
- **In transport and traffic:** This issue will be discussed in more detail at a later stage. Just to mention a few examples: investment in the rail sector, introduction of a distance-related motorway toll for heavy-goods vehicles in 2003, broad-based promotion of low-consumption motor vehicles (the so-called "5-litre car") within the scope of motor vehicle taxation. In aviation, introduction of an emission-related landing fee; at EU level, introduction of an emission-related air traffic duty
- **In industry:** Updated agreement between the federal government and German industry on climate protection of 9 November 2000 containing pledges by the different industries for exceeding their former commitments to reduce emissions by another 10 million tons of CO_2 by the year 2005 by another 10 million tons of CO_2 equivalents by the year 2012.
- **In government administration:** Emission reduction programmes for which the ministries themselves are responsible in order to reduce their own CO_2 emissions by 25 % by the year 2005 and by 30 % between 2008 and 2012. The Federal Ministry for the Environment as the ministry responsible for climate protection has taken a leading role in this effort

The emission forecasts are based on estimates that already take the effects of climate protection measures into consideration and suggest that greenhouse gas emissions for CO_2, CH_4, N_2O, HFHC, FHC and SF_6 will be reduced by around 25 % by the year 2005 and by around 30 % by the year 2010 compared to 1990.

CO_2 reduction in road traffic

Compared to other sectors, the German transport and traffic sector records the least favourable energy consumption trends in terms of climate protection. According to calculations based on the national transport emission estimation model TREMOD [21], traffic-related CO_2 emission in Germany has increased by more than 8 % or almost 17 million tons by 1999, with this figure increasing to around 16 % or 36 mil-

The Sixth Session of the UNFCCC Conference of the Parties to the United Nations Framework Convention on Climate Change

For a few days in November 2000, the interest of the press focused on global climate change. The Sixth Session of the UNFCCC Conference of the Parties to the United Nations Framework Convention on Climate Change at The Hague ended without a result and was adjourned to 16 to 27 July 2001 in Bonn. What happened?

The Kyoto Climate Protocol was to be defined in further detail in order to enable the industrialised nations to ratify the protocol. It contains a host of obligations, ranging from reporting obligations via technology transfer, support of developing countries to upper emission limits. A reasonable response must be defined for each violation of a covenant.

Another fiercely discussed issue is the consideration of natural carbon storages, such as forests or soils, the so-called sinks. Other open issues are related to the design of the Kyoto mechanisms, such as emission trading and support for developing countries. Focal subjects of the

UBA's involvement during the climate negotiations at The Hague were emission trading, consideration of sinks, as well as methodological issues.

The problems were primarily caused by the fact that climate gas emissions in most industrialised countries (member states of the Organization for Economic Co-operation and Development, OECD) have increased since 1990, often by more than 10 %. This is an obstacle to their joining the Kyoto Protocol with its covenants, all the more so because forecasts expect a further increase for the year 2010. The minimum requirements for the countries under the Kyoto Protocol are based on the 1990 emission levels which are not easy to comply with when coming from the high levels that have been reached by now.

(II 6.2)

lion tons, in each case related to the year 1999. The traffic-related CO_2 emission reductions of 15 to 20 million tons foreseen in the federal government's climate protection programme will only halve this increase, whilst a clear decrease was recorded in the industry and power sectors (by 29 % or 16 %, respectively, from 1990 to 1999).

The increase in traffic-related CO_2 emissions is chiefly due to a strong increase in road traffic – heavy-goods traffic on roads, in particular – and also in air traffic. Traffic is growing at a much higher rate than vehicle consumption is being reduced through technical measures. This is why CO_2 emissions from road traffic have been increasing up to now. The current trend of using the improvement in the efficiency of motor vehicle engines primarily to the benefit of more powerful engines and more extras and increased safety is hence contra-productive with a view to reducing CO_2 emissions. However, this trend is nevertheless likely to continue in the future.

In 1998, the Association of European Automobile Manufacturers (ACEA) pledged to reduce the average CO_2 emission for all newly registered passenger cars by 25 %, from 187 grams per kilometre (g/km) in 1995 to 140 g/km in 2008. The EU Commission is monitoring adherence to this pledge. The first report from 2000 notes: the average CO_2 emission by newly registered passenger cars fell around 6 % from 1995 to 1999, corresponding to around 1.5 % per year. Based on data released by the Motor Vehicle Office, the UBA has established similar results for Germany. During the same period, the average motor power increased by 4 % per annum on average, which, like heavier vehicle weight, counter-acts a reduction in consumption and CO_2 emissions.

The reduction in emissions is so far primarily due to the marked increase in the share of Diesel passenger cars (from 14 % to 28 % in Germany) where fuel-saving, direct-injection engines with turbo supercharger have additionally become widespread (share in the total number of newly registered Diesel passenger cars in the year 2000: over 90 %). This is, however, questionable from an environmental point of view: today's Diesel passenger cars perform only slightly better than required for the limit values of the EURO III standard, whilst passenger cars with Otto engines perform, on average, far better than required

for the limit values of the EURO IV standard. In terms of pollutant emissions, this means that nitrogen oxide emissions in a newly registered Diesel passenger car today are on average ten times higher than those in a comparable car with an Otto engine. Furthermore, Diesel passenger cars (save for a few exceptions) are up to now not yet fitted with particle filters and thus in their carcinogenic effect more than ten times worse than Otto passenger cars. It should, however, be noted that even direct-injection Otto engines still have to stand the test with regard to particle emissions.

Additional measures for reducing CO_2 emissions in road traffic

Is traffic growth a law of nature? No, says the UBA. What seems to be law – such as a correlation between increasing traffic and economic growth or technical development in automobile construction – can certainly be modified in such a manner that climate protection requirements are addressed.

For decades, production and settlement structures were promoted which forced goods and passengers to be transported over increasingly long distances and mostly by road. This must be corrected by revising urban and regional planning, as well as industry and settlement developments and the applicable promotion and subsidy programmes. Passenger transport must be reduced by bringing residential, shopping, recreation and working areas closer together, whilst goods traffic must be reduced by increasing manufacturing depth, i.e. by bundling several production steps in one place. Avoidance of traffic in this way also reduces CO_2 emissions. Shifting traffic to environmentally more compatible and more energy-efficient forms of transport can be achieved by additionally supporting local public transport in a manner that is orientated towards growing demand in conjunction with greater integration of all forms of transport through the use of telematics solutions. More than 10 million tons of CO_2 emissions can be avoided each year in this way.

Eco-tax: *The eco-tax aims at shifting the cost burden from the labour factor to the energy consumption/ environmental pollution factor. This is achieved by levying a tax that increases over time on the energy sources oil, gas, engine fuel and electricity. This tax, however, is not used to increase public revenue. Instead, it is meant to cut ancillary wage-related costs in order to boost the competitiveness of German products and hence to protect or create jobs.*

Road traffic: More than 10 million tons of CO_2 emissions could be avoided each year. (Photo: UBA/Hagbeck)

In the longer term, rail transport must be made more appealing in order to make it a real alternative to road traffic.

Every individual can contribute. A more sensible use of the car alone can save fuel by some 20 %. Driving at a low speed with slow acceleration and early changing to the next gear certainly does not affect the engine. On the contrary: it is possible to make the most of today's engines by driving in this sensible manner. Another highly welcomed side-effect: the risk of accidents is reduced substantially.

Rather than taking the car, an even stronger effect can be achieved by taking the bus, train or by cycling or by walking whenever shorter distances are concerned. Apart from adapting one's driving habits, the UBA recommends using light-running oils and light-running tyres, with each of these measures helping to cut fuel consumption by 5 %. Although light-running oils are relatively expensive, they usually pay off through reduced fuel consumption, longer oil-changing intervals and increased protection of the engine against wear. The Eco-label ("Blue Angel") was introduced in 1997 for low-noise and fuel-saving tyres for passenger cars. Odd enough, not a single manufacturer has so far adopted the Eco-label even though many tyres meet the criteria. A list is available on the Internet at www.umweltbundesamt.de/uba-info-daten/daten/reifen.

In this context, it is difficult to understand the row caused by the increase in fuel prices by more than 20 % during the course of the year 2000. Increasing world-market prices for oil and the so-called ECO-TAX showed some effect: in 2000, fuel consumption in Germany fell 4.7 % against the previous year. This is likely to be chiefly due to fewer trips by private car.

As a supplementary measure, the UBA advocates an above-proportion taxation of high CO_2 emissions within the framework of motor vehicle taxation in order to stop the trend towards ever-larger cars. In contrast to the motorway toll for lorries as provided for in the climate protection programme, the UBA recommends a heavy-goods transport duty for heavy-goods vehicles on all roads as a measure which promises a reduction in emissions of 3 million tons by 2010 (refer also to Part 2, page 111). *(I 3.2)*

Table 3: Green-house potentials of the major fluorinated gases

Compound	*Chemical formula*	*Greenhouse potential (100 years)*
H-FKW 23	CHF_3	*11,700*
H-FKW 134a	CH_2FCF_3	*1,300*
H-FKW 143a	$C_2H_3F_3$	*3,800*
H-FKW 152a	$C_2H_4F_2$	*140*
Sulphur hexafluoride	SF_6	*29,900*
Tetrafluormethane	CF_4	*6,500*
Hexafluorethane	C_2F_6	*9,200*
Carbon dioxide	CO_2	*1*

Sulphur hexafluoride & Co.: the underrated greenhouse gases

The fluorinated gases (HFHC and FHC, Table 1) which were included in the Kyoto Climate Protocol in addition to carbon dioxide (CO_2), methane (CH_4) and dinitrogen oxide (N_2O), as well as sulphur hexafluoride (SF_6), have so far gone relatively unnoticed in the public debate, even though forecasts indicate that emissions of these gases will strongly gain in importance because of their continuously increasing use in many applications. Measures to reduce emissions are hence particularly important in this field. Many of these substances have a greenhouse potential which is several thousand times higher than that of CO_2 (Table 3).

Partially fluorinated hydrocarbons (HFHCs): since the early 1990s, HFHCs have been increasingly used to substitute fully or partially halogenated chlorofluorohydrocarbons (FCFC or H-CFC) which damage the ozone layer and have a greenhouse effect. Applications using these substances are hence largely the same. The main sources of HFHC are currently polyurethane (PU) foam sprays (55 %) and refrigerating and air-conditioning systems (20 %). Further sources of emissions are PU foam in cans, asthma sprays, technical cold sprays and compressed-air sprays, as well as semiconductor production.

Triggered by forthcoming national and international legislation calling for the discontinuation of the use of chlorofluorohydrocarbons (CFC and HCFC), above-proportional growth in HFHC emissions was observed, emissions were 16 times higher in 1998 than in 1990.

A further increase in HFHC emissions must be expected by the year 2010. In a survey commissioned by the UBA, the authors estimate that, unless further action is taken, HFHC emissions will increase by around 800 % between 1995 and 2010 [22]. The production and use of PU foams and extruded polystyrene (XPS) foams account for almost 50 % of these emissions. Emissions from refrigerating and air-conditioning equipment will also play an important role in the future.

The decision in favour of future technologies is currently on the agenda for many application sectors. This will largely depend on political leverage, determining whether a move towards climate-friendly technologies will become possible or whether climate-relevant technology developments will be approved. The most important measures currently under discussion concern:

- **Refrigerating systems:** Obligatory maintenance for systems using HFHC and FHC in order to reduce leakage rates.
- **PU foam in cans:** Far-reaching replacement of HFHC as a foaming agent by propane/butane in conjunction with dimethylether (DME).
- **PU foam products:** Waiver of the introduction of HFHC as a foaming agent, and use of pentane, cyclopentane or water instead (CO_2).
- **XPS hard foam:** XPS can be produced today for many applications with CO_2 being used as a foaming agent. Measures should hence be taken in order to increase the share of foams using foaming agents other than HFHC.

Some measures are supported and implemented by the industry on a voluntary basis. In other areas, the government will have to create the basis necessary for accelerating the move away from HFHC technologies.

Perfluorinated hydrocarbons (FHC): Unlike HFHC, FHC is used as a substitute for CFC in just a few applications. The by far largest source of FHC emissions (71 %) is currently the production of primary aluminium. Due to extensive revamping projects and the shutting down of production capacities, emissions from this sector fell by more than 50 % between 1990 and 1998. This decline was in part set off by almost quadrupled emissions from the semiconductor industry which records annual growth rates of around 15 %. Emissions from the semiconductor industry are expected to increase eightfold by the year 2010. As a result, FHC emissions will increase by a total of 30 % between 1995 and 2010 [23].

The following concrete measures are currently being discussed:

- **Semiconductor production:** Replacing the FHC etching gases by nitrogen trifluoride (NF_3).
- **Aluminium production:** Further revamping and process optimisation projects.
- **New applications:** Omission of FHCs from further applications, such as surface cleaning and fire extinguishing agents.

These measures can reduce total FHC emissions by around 36 % against 1995.

Sulphur hexafluoride (SF_6): Emissions from car tyres are currently the largest source of SF_6 emission (55 %), despite the fact that the improved pressure retaining behaviour initially expected from SF_6 filling had no practical relevance. Sound insulating windows account for around 26 %, operating equipment in power stations for around 12 % of total emissions. Thanks to a dramatic reduction in emissions from sound insulating windows – which is partially due to the higher priority given heat insulation – the strongly growing trend in emissions seen in the early 1990s has reversed in recent years. The above-proportional increase in emissions from car tyres was partially offset by this development. Altogether, however, SF_6 emissions rose around 40 % between 1990 and 1998.

Considering the measures that have been implemented so far – primarily the covenant by German manufacturers and users of switchgear, as well as SF_6 producers to implement measures for restricting emissions – the authors of a study commissioned by the UBA estimate that SF_6 emissions can be reduced by 19 % between 1995 and 2010. The climate protection programme proposes a statutory ban on the use of major SF_6 emission sources because SF_6 in car tyres and windows can be easily substituted. This would enable SF_6 emissions to be reduced by 52 % between 1995 and 2010. *(III 1.4)*

Methane and dinitrogen oxide

Methane (CH_4): The greenhouse potential of methane is around 21 times higher than that of CO_2. Methane emissions world-wide account for around

20 % of the anthropogenic greenhouse effect. Methane is, for example, produced whenever organic material decomposes under anaerobic conditions (i.e. in the absence of air). Major portions of Germany's methane emissions come from animal-farming, the extraction, processing and distribution of fuels (coal, gas extraction and transport), as well as from the waste sector.

Methane emissions in 1998 were around 38 % down against 1990. The following major reduction potentials were used to this effect: reducing landfill gas emissions, increased use of the pit gases released in coal mining, rehabilitation and renewal of pipelines used for the distribution of natural gas, as well as increased biogas production in cattle farming.

Important measures for exploiting emission reduction potentials are available under the *Ordinance on Waste Landfills* which implements important elements of the *Technical Instructions on Municipal Waste.* These technical instructions set forth emission reduction requirements (collection and treatment of landfill gas) for all landfills where significant amounts of landfill gas are produced. The Technical Instructions on Municipal Waste and the *Technical Instructions on Waste* contain restrictive requirements for the quality of waste to be dumped, so that following certain interim periods (31 May 2005), only inert waste producing practically no landfill gases may be dumped.

Laughing gas (dinitrogen oxide N_2O): anthropogenic dinitrogen oxide emissions in Germany fell dramatically in Germany between 1990 and 1999 from 214 kilotonnes (kt; 1 kt = 1,000 tonnes) to 149 kt. This development is owed to measures for industrial processes which specifically include emissions from the production of adipic acid, an intermediate product of the nylon synthesis process. In 1998, a producer of adipic acid commissioned a plant for the catalytic cracking of N_2O, reducing N_2O emissions alone from 82 kt (1990) to 13 kt (1999). In contrast to this, emissions hardly changed in the case of the other two major sources of N_2O emissions, i.e. agriculture (79 kt in 1999) and fossil fuel combustion (28 kt in 1999). The potential for reduction has been largely exhausted in these sectors. *(II 6.2)*

[21] TREMOD (Transport Emission Estimation Model), developed by IFEU – Institute for Energy and Environmental Research Heidelberg: Data and calculation model: energy consumption and pollutant emissions from motorised traffic in Germany 1980–2020; a research project commissioned by the Federal Environmental Agency, December 1997, last model update on 13 March 2000.

[22] Schwarz, W.; Leisewitz, A.: Emissionen und Minderungspotenziale von H-FKW, FKW und SF_6 in Deutschland. [Emissions and reduction potentials for HFHC, FHC and SF_6 in Germany], UBA research report 298 41 256. Berlin 1999.

[23] This and the following forecasts: Intergovernmental Panel on Climate Change, Climate Change 1995.

8. Environment and health

Overview

- Introduction: the "Environment and Health" action programme
- The topics of the action programme
- Research projects on environment and health
- Quality of indoor air in Germany
- Indoor measuring methods and concentrations
- Emissions from construction products
- Eco-label for low-emission products
- Quality of indoor air: what's still required?

Introduction: the "Environment and Health" action programme

The "Environment and Health" action programme jointly carried out by the Federal Ministry for the Environment (BMU) and the Federal Ministry for Health (BMG) was published in June 1999 (Figure 11). The purpose of this action programme is to reach a comprehensive analysis of the health-related consequences of environmental burdens. This forms the working foundation for the further development of the "Environment and Health" policy field. This should be formed and implemented in intensive discourse between all the parties involved and affected. The aim of the "Environment and Health" action programme is to achieve a greater understanding of the interaction between the environment and health and to improve information and communication concerning risks to health. This focuses on:

- improving environmental/health monitoring and reporting,
- developing a concept for the evaluation and communication of risks,
- improving information management,
- promoting the scientific enhancement of environmental medicine,
- improving existing structures in the federal authorities responsible for environmental protection,
- promoting research into the environment and health, and
- intensifying international co-operation.

Moreover, the programme contains substance-related quality objectives for the following areas that aim at a further reduction of environmentally-based health burdens:

- Outdoor air and climate
- Indoor air
- Water resources, soil, food
- Ionising radiation
- Noise
- Substances and preparations

Documentation [24] is available on the action programme that reflects the status of the different discussions and which presents and explains the measures recommended in detail. The UBA was involved in this.

Figure 11: The "Environment and Health action programme"

The topics of the action programme

Within the scope of implementing the "Health and Environment" action programme, structures were created that led to intensive co-operation between the BMU (Federal Ministry for the Environment), BMG (Federal Ministry for Health) and the participating federal authorities

- Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV)
- Federal Environmental Agency (UBA)
- Robert Koch-Institut (RKI) and
- Federal Office for Radiation Protection (BfS).

The steering group is responsible for co-ordinating and organising the measures. A co-ordination group with its office in the UBA manages communication between the participating authorities. This co-ordination group is chaired by a representative of a different authority each year and was chaired by the UBA up to October 2000.

Some of the tasks defined under the "Health and Environment" action programme are the responsibility of the federal states and it hence makes sense to handle these issues in co-operation with the federal states. This co-operation is carried out through a federal-state work group for environmentally related health protection that contains a project group for the implementation of the action programme on a federal state level.

Particular attention is to be given to the relationship between environmental stresses and children's health. Apart from radiation issues, the UBA is involved in all major aspects in this field. The subject of "media and substance-related quality aims" is one of the key working issues of the Agency and involves a large number of working units. Progress in this field is hence presented at many different points in this Annual Report.

The interactive chat-room discussion forum on the action programme contributes towards improving information and communication strategies in the field of "environment and health". This website is financed through the Environmental Research Plan (UFOPLAN) and was established in Osnabrück in November 2000 within the scope of the Environmental Medicine Information Forum (UMINFO) of the Documentation and Information Centre for Children's Environmental Health.

The Robert Koch Institute (RKI) is responsible for the design and management of this website. The idea behind this Internet forum is to integrate the public into this action programme. The website can be reached on the Internet at: www.uminfo.de/aktionsprogramm. *(II 2.1)*

Research projects on environment and health

Within the scope of the "Environment and Health" action programmes, the UBA is managing a series of research projects, including the following:

Examinations into sensitivity to chemicals (Multiple Chemical Sensitivity, MCS): The aim of this project that is being managed by Robert Koch Institute is to examine within the scope of an integrated MCS survey the frequently referred to hypothesis that states that the sensitivity seen in MCS patients is caused by hereditary deviations in the enzyme balance. *(II 2.1)*

Concept for the development and easily-understood presentation of information on chemicals and products that are relevant for the environment and health: The aim of this project handled by the BgVV (Federal Institute for Health Protection of Consumers and Veterinary Medicine) is to find out whether it is possible to develop a generally understandable compilation of the contents of the various databases of federal and state governments concerning certain chemicals and products and to be made available to the public in electronic form. The CIVS database (a chemicals information system for consumer-relevant substances) that was set up in 1999 in the BgVV marks a first small step in this direction. This database can be accessed on the Internet at: www.bgvv.de/fbs/chem/index.htm. Although the CIVS up to now only contains health-related information, plans exist to include environmental information in the future. *(II 2.1)*

Effects of climate change on animal-borne dissemination of pathogens relevant in human medicine: The dissemination of pathogens must be feared in Germany as an indirect consequence of the greenhouse effect (refer to chapter 7) and other (anthropogenic) changes caused by humans. Within the scope of this project, the Institut für Medizinische Parasitologie at Universität Bonn is to examine which effects climate changes have on the dissemination and survival of pathogens and their carriers in conjunction with other factors – such as importation and altered travel behaviour. *(II 6.2)*

Quality of indoor air in Germany

Private rooms account for the by-far greatest share of permanently used indoor rooms. This special situation also explains why legislation can only improve the quality of indoor air to a certain extent and personal behaviour patterns often play a decisive role. This becomes particularly clear with the example of

smoking in indoor areas. This is particularly where public information must begin.

Indoor air hygiene is one of the important issues in health-related environmental protection – together with other topics, such as protection against the negative effects of noise and ensuring good drinking water supply.

Germany has a long tradition in the field of indoor air quality. In the mid 19th century, the hygienist Max von Pettenkofer established a value of 0.1 % as the hygienically acceptable volume content of carbon-dioxide (CO_2) in the air, this was later referred to as the "Pettenkofer ratio" in honour of his work. At the same time, restricting the metabolic product CO_2 exhaled by humans was also intended to keep the concentration of bodily perspiration leading to unpleasant odours below a tolerable level.

Pettenkofer drew his recommendation from his own observations and experience. The Pettenkofer ratio has since served as a foundation for generations of engineers and ventilation technicians for calculating the air change rates required for indoor areas. The world of indoor air remained relatively quiet for a long time after Pettenkofer. It was not until after World War II that a few scientists became interested in finding out to what extent the concentrations of substances regularly measured in outdoor air, such as sulphur dioxide, nitrogen dioxide or carbon monoxide, could be found in indoor air. The ratio between the concentration of a substance in indoor air and the concentration of the same substance in outdoor air was usually below 1. This means that the indoor concentration was lower than the outdoor concentration, so that indoor areas offered a protective function compared to outdoor air pollution.

Another, relatively frequent situation, however, occurred when indoor areas had emitting sources (for example, tiled stoves, gas cookers, tobacco smoke, candles) – in conjunction with incineration procedures. Rates were then often observed that were above 1. Indoor/outdoor air concentration ratios of much higher than 1 were often measured for organic/chemical compounds that increasingly appeared in indoor areas thanks to "modern" products – such as, for example, construction materials, furniture and fittings, varnish and paint. Some of these compounds became the focus of more public attention, including formaldehyde and pentachlorophenol (PCP). However, legislation has meanwhile helped to reduce concentrations of these substances considerably.

In 1981, the Institute for Water, Soil and Air Hygiene (WaBoLu) that formerly belonged to the Federal Health Office (BGA), together with foreign experts, organised the first national conference on the subject of indoor air hygiene. In 1987, the Institute organised the 4th International Conference on Indoor Air Quality and Climate (Indoor Air '87). In 1986, the Indoor Air Hygiene Commission was set up at the Institute for Water, Soil and Air Hygiene in order to advise the Federal Health Office (BGA). Meanwhile, highly recognized experts from various sectors relevant for indoor air have been appointed to this commission. This Institute, which was incorporated into the UBA in 1994, has since 1993 been holding the WaBoLu meeting on indoor air every year which has become a recognized forum of expert exchange.

In 1992, the federal government published the "Concept by the Federal Government to Improve the Quality of Indoor Air" that was drafted by an inter-ministry work group under the leadership of the BMU (Federal Ministry for the Environment). Among other things, this concept made it clear that there is a vast range of legal requirements that affect the quality of indoor air. In a special section of the concept that compiles information concerning the most important issues relevant for indoor areas, around 100 recommendations were made for measures and research projects to improve the quality of indoor air. Many of these recommendations, which also partially fell under the competence of the federal states, have meanwhile been put into practice, whilst solutions still have to be found for certain recommendations since they can only be implemented on a long-term basis.

Indoor measuring methods and concentrations

The measuring strategy is particularly important when examining indoor air. For several reasons unfortunately, and not least due to the costs involved, examinations of indoor air generally involve only a small number of measurements. In many cases, a single measurement must often suffice and is then wrongly considered to be representative for the permanent situation in the room in question. This is why

the optimum measuring strategy is particularly important since the time of measuring in the respective room has a decisive impact on the result measured. This simply must be taken into account when interpreting the measured results.

The air change has a particularly strong influence on the measured result, because the extent of ventilation determines the thinning of the substance concentration. However, the time measuring is carried out and the position of the measuring equipment in the room can also be important. In order to standardize procedures here, a committee was established at the Commission for Air Quality Management in the Verein Deutscher Ingenieure (VDI) and in the Deutsche Institut für Normung (DIN). The work groups of this committee develop VDI guidelines for measuring indoor air. The contents of these national guidelines, particularly guideline series 4300, are continuously integrated into standards on a European level (European Committee for Standardization, CEN) and on an international level (International Standardization Organization, ISO).

The importance of standardized recommendations for the health-related evaluation of substance concentrations in indoor areas soon became clear with the example of formaldehyde: in 1977, an ad-hoc Federal Health Office commission recommended a value of 0.1 ppm (parts per million), corresponding to 0.12 mg/m^3, for formaldehyde concentrations as still being acceptable for indoor air. Recommended values for other substances, for example, for polychlorinated biphenyls (PCB), were then issued in response to topical issues.

In order to create a uniform and transparent basis, co-ordinated between federal government and states, for recommending values, an ad-hoc work group has been in action since the mid 90s and is made up of members from the previously mentioned Indoor Air Hygiene Commission and representatives from the federal states. These were appointed Working Group of the Federal States on Health Protection (LAUG) within the Working Group of Senior Federal Health Authorities (AOLG). The ad-hoc work group published a general evaluation framework in 1996 and has since adopted this to derive guide values for a series of individual substances as well as for the sum of volatile organic compounds in indoor air. These guide values have already made their way into practical evaluations.

Both the Indoor Air Hygiene Commission and the ad-hoc work group are also contributing towards solving the acute problems related to evaluation. One very recent example of this is the problem in conjunction with the occurrence of polycyclic aromatic hydrocarbons (PAHs) in house dust. Increased volumes of PAHs, some of which can cause cancer, were found under certain conditions in house dust where tar-containing materials were used to glue parquet tiles.

(II 2.3)

Emissions from construction products

The *Council Directive 89/106/EEG on construction products* also provides that structures should not endanger the health of room users through the emission of pollutants from construction products. This directive was implemented on a national level in 1992 with the *Construction Product Law*. Based on the knowledge that it makes more sense to combat evil at the source, health-related limit or guide values must be defined for construction products (refer also to chapter 1).

In order to solve the complex problems of implementing the demand for low-emission construction products, the aforementioned Working Group of the Federal States on Health Protection (LAUG) of the Working Group of Senior Federal Health Authorities (AOLG) established the Committee for the Evaluation of Health-related Impacts of Construction Products (AgBB) in 1997 which has its office in the UBA. Following intensive preliminary work, the AgBB published an evaluation scale for construction products. This scale is available in German on the Internet at: www.umweltbundesamt.de, under: "Daten und Fakten – Bauprodukte". The aim is to discuss this scale with experts, including manufacturers, during the first half of 2001 and to subsequently define a final procedure.

Eco-label for low-emission products

The "Health and Environment" action programme demands that products that are environmentally friendly and pose no risk to human health be marked in order to enable consumers to make a choice. Construction products and materials for furniture and fit-

tings that are widely used in indoor areas are an important issue in this context.

The labelling of products with the "Blue Eco Angel" (refer to chapter 6 and Part 2, page 150) placed particular emphasis on health-related requirements from the very beginning. This means that, for example, particularly critical substances (with carcinogenic, mutagenic and embryotoxic properties) may not be added to the products. In the case of different product groups, emissions have been measured for some years now and restricted on the basis of specified maximum values. Sometimes, alternatives are also awarded with this label that do not cause any comparable emissions (Table 4, page 66).

Some important changes have taken place in 2000 with environmental labels for low-emission products. With the new environmental label for low-emission products made of wood and timber (RAL UZ 38, since September 1999), a series of well-known furniture ranges, laminate flooring and panels were awarded following comprehensive test-chamber measurements. The new "Blue Angle" replaces the former environmental label for low-formaldehyde wood products and takes not just the emission of formaldehyde itself into consideration, but also the emission of other organic toxic substances into indoor air. Furthermore, other requirements are also placed on the life cycle (environmentally compatible production and disposal) (Figure 12).

Another environmental label was created for the product group that covers emulsion paints (RAL UZ 102, since May 2000). Due to the large-scale use of conventional products, the relevant volumes of volatile organic compounds as well as preservatives can ultimately lead to health damage. This is why the environmental label focuses on restricting the emission of volatile organic compounds as well as the targeted selection and restriction of preservatives. All major manufacturers now offer paints bearing the environmental label.

Figure 12: Eco-label RAL-UZ 38 for low-emission products made of wood/timber

On the whole, the new environmental label marks an important step towards labelling low-emission products. Taking the evaluation scale for construction products drafted by the AgBB into consideration, environmental labels for other product groups are currently in the making. *(III 1.4)*

Quality of indoor air: what's still required?

Just like many other tasks in the field of health-related environmental protection, improving the quality of indoor air is a long-term commitment, particularly since unexpected issues persistently pop up that are rooted in "historical burdens" – as shown by the aforementioned example of the parquet floor glue with PAHs.

Microorganisms: Activities by the UBA's Indoor Air Hygiene Commission currently focus on one subject, the importance of which has been underestimated up to now: the occurrence of microbiological impurities in indoor areas. In analogy to the Manual for Interior Air Hygiene in School Buildings published by the Commission (refer to Part 2, page 124), a report is being prepared that intends to clearly show the importance for human health of microorganisms in indoor areas and to provide recommendations for avoiding their occurrence. Microbial stresses for indoor areas are also on the agenda of the 2001 WaBoLu meeting on indoor air. Both activities aims at providing general information and explanations for consumers – an important aspect of public relations for improving the quality of indoor air.

Organic compounds: Further activities are required in order to provide more information on heavy volatile organic compounds (HVOCs) both in relation to their occurrence and their evaluation in terms of health. HVOCs are emitted by materials and products. Since they are often attached to dust particles, it is also particularly important in this re-

Table 4: Low-emission products with the eco-label (original german terms are noted)

RAL-UZ 34	*Insektizidfreie Schädlingsbekämpfungsmittel für Innenräume*	*weil ohne giftige Wirkstoffe*
RAL-UZ 38	*Emissionsarme Produkte aus Holz/Holzwerkstoffen (für Innenräume)*	*weil emissionsarm*
RAL-UZ 57	*Thermische Verfahren (Heißluftverfahren) zur Bekämpfung holzzerstörender Insekten*	*weil schadstoffarme Schädlingsbekämpfung*
RAL-UZ 62	*Emissionsarme und abfallmindernde Kopiergeräte*	*weil emissionsarm und abfallmindernd*
RAL-UZ 76	*Emissionsarme Holzwerkstoffplatten*	*weil emissionsarm*
RAL-UZ 85	*Drucker*	*weil emissionsarm und recyclinggerecht*
RAL-UZ 95	*Faxgeräte, Fernkopierer und Faxkombinationsgeräte*	*weil emissionsarm und recyclinggerecht*
RAL-UZ 101	*Gas- und Elektroherde*	*weil energiesparend, emissionsarm und recyclinggerecht*
RAL-UZ 102	*Emissionsarme Wandfarben*	*weil emissionsarm*

spect that living rooms be cleaned thoroughly on a regular basis.

Laboratory quality: When it comes to indoor air examinations, the reliability of the measured results is also closely linked to the quality of the laboratory performing the examination. In view of this knowledge, the Indoor Air Hygiene Commission has taken up the subject of quality assurance beyond the scope of the activities referred to above that are being carried out by the Commission for Air Quality Management at VDI and DIN.

Odours: A practically important yet up to now unsolved problem is related to the issue of "objective" odour management in indoor areas. Up to now, it has not been possible to find a satisfactory instrumental method, so that the human nose with all its subjective uncertainties must still be used as a detector.

The problem with insulation? There is still uncertainty, for example, with regard to the negative effects on health resulting from the new energy saving regulations. Based on the experience of the 1970s, worried commentaries have been issued in the sector for some time now, stating that the measures designed to save energy could have a negative impact on the quality of indoor air. It is currently still difficult to assess this clearly as there are still insufficient facts available that could either prove these possible disadvantages or allay fears. Whether the trend towards greater use of mechanical ventilation in private homes and – generally speaking – to the automated house is the right way must still be examined in greater detail. *(II 2.3)*

[24] Dokumentation zum Aktionsprogramm Umwelt und Gesundheit: Sachstand – Problemaufriss – Optionen [Documentation on the "Environment and Health" action programme: status quo – outlining problems – options] available from the Public Relations departments at the Federal Ministry for Health (Am Probsthof 78 a, 53121 Bonn, Telephone: +49 228/9 41-0, Fax: -4904) and at the Federal Ministry for the Environment (Alexanderplatz 6, 10178 Berlin, Telephone: 01888/305-0, Fax: -3225).

9. Greater protection for drinking water

Overview

- Introduction
- Water supply in Germany: principles, responsibilities and interests
- New drinking water ordinance: an improvement
- Role of the EU Framework Directive on Water Policy
- Costs versus quality?
- Risks inherent in the liberalization of water supply

Introduction

In the year 2000, scientific and political debate as well as the Federal Environmental Agency's (UBA) drinking water activities focused on the discussion concerning the revision of the *Drinking Water Ordinance (TrinkwV),* the *EU Framework Directive on Water Policy (Directive 2000/60/EU),* and the *Guidelines for the central supply of drinking water (DIN 2000).*

The amended Drinking Water Ordinance had to include the provisions of the *Infection Protection Law* and completely implement the *EU Directive on Drinking Water (Directive 98/83/EU).*

It was particularly important in this context to maintain the generally high or very high quality of drinking water in Germany and, in as far as possible, to improve this. Safety for health protection was substantially increased by some amendments to the ordinance which did not have any negative implications for the status quo.

Apart from the two laws, the amended Drinking Water Ordinance for the implementation of the EU Directive on Drinking Water and the Framework Directive on Water Policy, the effect of the Guidelines for the central supply of drinking water (DIN 2000) should not be underestimated in comparison with the two laws since this does in fact form the foundation for the individual commitment undertaken by the water supply companies that fall under the Drinking Water Ordinance. This ordinance states that water can only be seen to be "fit for consumption and pure" when, together with the requirements of the ordinance, the generally recognized technical rules are applied during processing. This means that drinking water must be absolutely free from pathogens or chemical substances that could endanger human health. If microbiological burdens or health-impairing substances are likely due to the raw water quality, then processing must be carried out together with disinfecting.

Whilst the discussion on these laws and hence aspects of drinking water protection was restricted to expert circles, the move forward by the German Federal Ministry of Economics and Technology in favour of the liberalisation of the German water sector has led to greater public awareness for this subject.

More in-depth questions, for example, as to whether liberalisation could endanger the safety of water supply or whether it could lead to the neglect of municipal tasks, for example, the protection of resources, were discussed by experts only, with the mass media showing only a slight interest in this topic. However, this always suddenly changes when the neglect of drinking water protections leads to pollution with pathogens or chemical substances in a district or municipality.

Water supply in Germany: principles, responsibilities and interests

The federal states are responsible for the supply of drinking water. Every year, the federal states submit to the federal government their reports on adherence to limit values and the requirements of the Drinking Water Ordinance. The UBA gathers these reports, approvals for limit-value violations and evaluates this information. The health authorities in the federal states are responsible for monitoring the quality of drinking water in Germany.

Instead of protecting just a few drinking water abstraction areas for spring water or mineral water, Germany has adopted a principle of protecting resources as a whole, in other words, first and foremost groundwater. This is hence also closely linked to environmental protection in general and in particular to the requirements for waste water treatment. The familiar preventive protection that has been in place in Germany since the end of the 19th century is now described on an international level by the term **MULTI-BARRIER-PROTECTION**. The three areas, referred to as groups A, B and C, are subject to different laws and responsibilities:

- Protection of Resources – Group A (framework directive on water policy; *Federal Water Act (WHG):* responsibility of the federal states.
- Abstraction, treatment and distribution – Group B (Drinking Water Ordinance, DIN 2000): responsiblity fo the water supply comapnies, usually falls under municipal responsbility.
- Household installation – Group C (Drinking Water Ordinance, DIN 1988): private responsbility.

The integration of water supply companies has proven to be worthwhile. The responsibility borne by the communities both for the protection of resources and for water supply creates a common interest group that could be lost during the liberalisation of the water supply sector. This topic will be dealt with in greater detail below. An ideal combination of common interests is achieved when the supply of drinking water and the treatment of waste drinking water – waste water disposal – are in one hand. After all, look at the successful co-operation between the water supply sector and the agricultural industry which made it possible to reduce the stresses on the environment caused by plant protection products to an acceptable level, i.e. to the limit value of 0.1 micrograms per litre (µg/l) specified in the Drinking Water Ordinance. Adherence to this drinking water limit value in the groundwater when using plant protection products is recognized as proof of orderly agriculture.

Multi-Barrier protection: *Includes the protection of resources (for example, groundwater) using protection zones; protection of water abstraction; careful treatment with selected treatment substances; maintenance of the pipe network; carefully execution of household installation using suitable materials.*

Quality requirement: *Quality requirement as specified by law (Drinking Water Ordinance, Infection Protection Law, Food Law).*

The costs of the diverse measures for the protection of resources cannot be precisely estimated. It is even more difficult to determine which part is to be attributed to drinking water and which part is necessary in the first place for environmental protection in general. And drinking water suppliers are only obliged to contribute to these costs within the scope of Section 19 of the Federal Water Act (compensation for measures in protection zones) or according the co-operation principle. This refers to the co-operation between polluters (agriculture, industry) and those affected (water suppliers, consumers). The aim here is to agree to the ideal measures in the interest of the environmental and health protection. It is one possible form of democratic control and local participation.

A contribution of EUR 0.05 per cubic meter (0.05 EUR/m^3, corresponding to 2 to 5 % of the price of drinking water) is normal practice. It is lower than the groundwater rate charged in some federal states (in Berlin, for example 0.31 EUR/m^3), however, it can be used more directly than rates managed by the public sector because based on the co-operation principle it can be used directly for measures in the interest of health protection.

The second large group, Group B, is the abstraction, treatment and distribution, generally referred to as "water supply". Characteristic here is the fact that 70 to 80 % of costs are spent on building and maintaining the pipe network whilst abstraction and treatment only account for a small share of the overall costs. In the opposite direction, the costs that result from **QUALITY REQUIREMENTS** do not have a significant role to play. This means that the fear that very strict limit values could lead to over-priced drinking water is unfounded. However, the demand for drinking water to reach consumers in the same quality as it leaves the water works is leading to greater requirements being placed on the maintenance of pipe networks. This results in higher costs compared to regions where pipe network maintenance is not carried out with the same thoroughness as is customary is Germany. Pipe network maintenance can be termed as "good" in relation to drinking water protection when the pipe network losses caused by leakage are

below 5 % and when no additional disinfectants (chlorine or chlorine dioxide) are needed in order to transport a microbiologically clean water from the water works to consumers.

The third area, Group C, falls under the responsibility of building owners. This includes, for example, the costs of pipe installation, for fitting bathrooms and kitchens as well as for technical equipment such as washing machines and dishwashers. These costs partly belong to private life and are partly included in the rent. Just how high these costs actually are can only be guessed. Based on rough estimates of costs for modernising apartments, this would probably mean annual costs in the region of EUR 256 to 511 for a model family of four (see below "Costs versus quality"). The market of house installations is wide open.

Drinking water in Germany: excellent quality. (Photo: courtesy of BMU)

The discussion on the replacement of lead pipes shows just how explosive this cost group is. Even though suitable materials are available today (stainless steel and tested plastics) and even though the toxic effect of low lead concentrations – in particular on small children – has been known for many decades, for cost reasons, a moratorium of 15 years was still granted throughout Europe until the limit value, which is vital from the point of view of health, of 10 micrograms per litre (µg/l) comes into effect.

However, in this case consumers themselves have the power to avoid contaminated water by simply letting water run until water than has been standing in lead pipes for more than two hours simply flows away and unburdened water from the public network flows from the tap. This usually only takes about two to three minutes.

New drinking water ordinance: an improvement

The aim of the amended Drinking Water Ordinance that was announced in the first half of 2001 and will come into effect on 1 January 2003 is to supply drinking water that is "suitable for consumption and pure". However, the Drinking Water Ordinance is only a minimum requirement as the following example demonstrates: under the current Drinking Water Ordinance, water that has measured values equal to the limit values for a number of parameters, e.g. cadmium (Cd), lead (Pb), mercury (Hg), pesticides and which also has microbiological parameters that are just about within the scope of what is permitted, would not be criticized, even though this would be fully unacceptable from the point of view of hygiene. According to the amended Drinking Water Ordinance, on the other hand, this would certainly be reason for criticism because this ordinance demands that technical rules be adhered to according to the DIN 2000 standard previously referred to. When these rules are adhered to, the values for the majority of parameters are far below the limit values. These limit values are then only occasionally reached.

Furthermore, the amendment also demands that substances used for treatment fulfil the strictest conventional purity requirements. This is why Germany is insisting that when these standards are being established on a European level (in the European Committee for Standardisation, CEN) apart from substances with minor requirements (Group B or C), substances with stricter requirements (Group A) also be standardised. When approving treatment substances according to the Drinking Water Ordinance, reference is then made to Group A.

Another new option is to take longer periods – a maximum of nine years when the European Commission grants its approval for the case in question – to clean up water supply following limit-value violations. This will be beneficial, particularly in co-operation with the agricultural sector, when limit values for the nitrate and pesticide parameters are exceeded. This is intended to give priority to the principle of avoidance and co-operation over treatment measures. In detail: the protection of resources is the most important and effective barrier against pathogens and potentially health-endangering substances. Pathogens that are resistant to disinfection can be best overcome through avoidance strategies.

When selecting material, the UBA, in co-operation with other member states, is trying to develop a European test system for pipes that is intended to standardise current recommendations, for example, the so-called KTW recommendation (recommendation on the use of plastic and other non-metal materials for the drinking water sector) by the former Federal Health Office that is widely recognized on an international level.

Role of the EU Framework Directive on Water Policy

Between 1972 and 1980, a number of EU directives were adopted that deal with water protection. Apart from the EU Framework Directive on Water Policy (formerly Directive 80/778/EEC, now 98/83 EU and the implementation of the amended Drinking Water Ordinance), the following directives have either a direct or an indirect influence on drinking water supply:

- EU Directive on the quality of surface water intended for the abstraction of drinking water (75/440/EEC),
- EU Directive on groundwater (80/68/EEC),
- EU Directive on the discharge of dangerous substances (76/464/EEC).

There are currently over 30 EU directives that have either a direct or an indirect effect on the water sector. This "patchwork" that has developed over the past twenty years on the basis of different needs and problems is marked by considerable shortcomings and inconsistencies. The European water directives fail to form a satisfactory foundation for modern-day water policy.

This is why the EU Commission has since 1994 been trying to create a modern, coherent European water legislation and in 1996 decided to exempt the EU Directive on drinking water from this. The *EU Framework Directive on Water Policy of* 22 December 2000 has two central objectives:

- to protect and improve aquatic eco-systems,
- to promote the sustainable use of water resources.

Within the scope of these objectives that aim at achieving a good condition in seas and lakes, the following targets have also been set:

- the ongoing reduction of water pollution with hazardous substances according to the OSPAR and HELCOM marine protection conventions (for more information, refer to chapter 1),
- the reduction of the ecological effects of flooding and drought.

This means that drinking water hygiene and the aims of the framework directive on water policy can be brought together. Both groundwater protection in drainage basins for drinking water supply as well as protection against hazardous substances appear to be sufficient. Particularly in view of the fact that the framework directive on water policy explicitly states that any worsening of the aquatic environment must be avoided. Establishing basin plans for basins, when necessary in co-operation with international basin commissions (refer to chapter 2) – i.e. beyond the borders of the member states (and the federal states) – appears to be a suitable control instrument for securing a sustainable supply of unobjectionable drinking water. This is linked with considerable hopes, even though the deadlines for implementing the framework directive on water policy appear to be very long, ranging from around 18 to 30 years. The DIN 2000 guidelines also include the covenant that supply companies are also to become involved in the protection of resources, for example, by participating in such commissions.

Costs versus quality?

Reliable supply and the demand for quality at a reasonable cost can be achieved in several ways. Behind closed doors, not just in Germany – but world-wide, discussions are being held on whether the concept of high-quality tap water should be discarded, and instead bottled drinking water, for example, spring water or mineral water, should be used.

The consequences of this have never been seriously examined. However, rough estimates for Germany already indicate that this approach would at least triple direct costs for consumers. Conclusion: The most cost-effective and safest way is to supply unobjectionable drinking water from the tap. But what exactly does this mean? Demand for drinking water covers two areas:

- General hygeine (for example, personal hygine, laundry, home cleaning): this requires around 100 litres per citizen and day (l/d). The summary of reasons for the Drinking Water Ordinance states 20 l/d as the minimum amount in emergencies with tank lorry supply.

- Drinking water as a basic foodstuff: including the preparation of food and beverages, at least 3 l/d are required, with 5 l/d being more likely.

In order to cover the overall demand, this means costs of around EUR 77 per person and year in Germany. For a family of four, this would mean annual costs of EUR 307 for drinking water supply. This sum dos not include waste water disposal. Taking the German average, this family then buys 400 litres of mineral water or spring water every year, at an estimated cost of EUR 205. These additional costs are not mandatory, because drinking water from the tap – just like mineral water or spring water – contributes towards a balanced diet. Drinking water can also hold its own when compared to mineral water or spring water when it complies with the aforementioned standards, in particular, DIN 2000; it must be cool, clear, appetizing and entice consumption.

The costs that must be borne by a family of four would increase dramatically if the protection of drinking water were to be neglected and hence resulting in a decline in trust in drinking water from the tap. This model family would be forced to buy an additional 2,000 litres approx. a year in bottled drinking water, spring water or mineral water, costing no less than EUR 511 a year. They wouldn't even be able to make any significant savings in the cost of supply from the tap. In contrast to industrialized countries, in less developed countries the costs of drinking water account for a very high share in the cost of living. It is also at its highest when water is supplied through private water sellers and not via permanent pipes. There is a basic global understanding that supplying drinking water from the tap (as a basic foodstuff or to protect against disease) is the cheapest form of water supply.

Risks inherent in the liberalization of water supply

Now that the markets for electricity, gas and telecommunications have been liberalized in Germany, the liberalization of drinking water supply is the subject of heated discussions – also in view of the initiatives which may be introduced by the EU Commission. The UBA has examined the possible effects which this type of market opening could have on health and environmental protection, and has published a survey of this in November 2000. This survey is available as a PDF file in the Internet at: www.umweltbundesamt.de/wasser [25].

In contrast to electricity and gas, section 103 of the German *unfair competition law* as amended in 1990 still applies to the water supply sector. This law releases regional monopolies from the general rules of antitrust legislation and enables the establishment of agreements that secure these monopolies. At the moment, between six and seven thousand companies are supplying Germany with drinking water. These companies are to a great extent under municipal ownership. The deletion of section 103 of the German *unfair competition law* would eliminate protection for the municipal water markets, hence opening them up for other companies.

The possible impacts of the liberalization of the German water market depend both on the precise legal framework as well as the respective regional circumstances. One thing is certain, i.e. that during the course of liberalization, Germany's water supply market would witness greater competition. This would be likely to go hand in hand with more pronounced privatization and concentration trends among the supply companies. In what would be initially a limited extent, customers may even compete with each other where key customers would be supplied through a competitor's network or were several suppliers feed into one network. The framework conditions for these scenarios, however, are unclear.

The UBA fears that as a consequence of liberalization the successes already achieved on the road towards sustainable water management could be endangered. Sustainable water management means that water is used in such a manner that the needs of people today and the environment can be satisfied. This means that the availability of water and the dependent eco-systems may not be changed in a way that could lead to restrictions for future use. Many of the services for resource, environmental and health protection that are rendered today within the scope of water supply are not individually laid down in law and are difficult to monitor. These "voluntary" services could be cut back in a liberalized water market or even discarded: these include the widely regional character of water abstraction and distribution in conjunction with the comprehensive measures implemented by water suppliers for the protection of resources, the environment and human health.

The concentration of water supply companies due to market liberalization is likely to lead to the neglect of smaller water abstraction areas. This is particularly true when the local protection of resources – primarily groundwater protection – proves to be more expensive than moving to other sources where there are not conflicts in terms of uses. In the long term, this would lead to a greater breaking down of the country into water-using regions (above all, densely populated areas and areas with intensive agricultural use) and water-supplying regions (areas with sufficient supply of water and at the same time a low contamination rate and a comparatively low demand for water). The liberalization of the market would strengthen this break-up, which is already visible, and would further hinder efforts to combat these trends for environmental reasons.

As a result of the opening up of the market, cost pressure on companies would increase, forcing them to cut costs. This trend could become a problem if these measures have a negative effect on the quality of the drinking water supplied. This applies irrelevant of whether the parameters of the Drinking Water Ordinance are adhered to or not.

Maintenance of the pipe network is one possible area for cutting costs with consequences for hygiene. For example, it was seen during the course of the liberalization of the electricity market that investment in maintenance was at times drastically reduced. In the case of drinking water supply, insufficient maintenance of the pipe network leads to greater leakage which means that impurities can enter the pipe network. This can then require the addition of more disinfectants – for example chlorine – which, in turn, impairs the quality of the drinking water. Cost-cutting measures in water treatment can also lead to lower quality.

Direct competition that is basically possible in a pipe network and the related (under certain circumstances non-co-ordinated) mixing of different types of water increases the pressure to chlorinate the drinking water. Whether the technical, hygienic and liability issues that arise during this kind of mixing can be solved satisfactorily is unclear and in the opinion of the UBA doubtful. This means that it is safe to assume that on a short-term basis direct competition for customers will not become significantly important in Germany.

Taking an overall annual turnover in drinking water supply in Germany of around EUR 6 billion, where pipe network costs account for around 70 %, it seems quite clear that the liberalization of this market promises only a modest potential for public welfare gains – in contrast, for example, to the telecommunications market. Today's estimates for improvements in efficiency of between 10 and 15 % are considerably lower than those estimated for electricity and telecommunications services (and are – at least partially – also possible without having to liberalize the market).

A legal evaluation showed that prior to liberalizing water supply another constitutional examination is required since such liberalization can be seen as intervention into the constitutional right of local self-government.

All in all, it must be said that with a view to health and environmental protection the liberalization of water supply raises serious doubts. *(II 3.1, II 4.1, I 2.2)*

[25] "Liberalisierung der deutschen Wasserversorgung – Auswirkungen auf den Gesundheits- und Umweltschutz, Skizzierung eines Ordnungsrahmens für eine wettbewerbliche Wasserwirtschaft" [Liberalization of German water supply – effects on health and environmental protection, outlining an ordinance framework for competitive water management] (TEXTE 2/00), available from the UBA's central answering service (address: page 94).

10. Soil protection as a cross-sectional task

Overview

- Introduction
- Ecotoxicological evaluation of soil quality
- Distribution and action of chromium in the soil
- Rehabilitation of contaminated sites and land recycling
- Soil protection and agriculture
- Data for soil protection
- Nation-wide soil information system

Introduction

The practical implementation of the *Federal Soil Protection Act (BBodSchG)* and the *Federal Soil Protection and Contaminated-sites Ordinance (BBodSchV)* shows that soil protection law has implications in many respects for other environmental laws, such as fertilizer law, plant protection law, waste law, construction law and regional planning law. The cross-sectional character of soil protection calls for suitable activities to combat existing shortcomings in order to harmonize soil-related requirements against the background of paths of action and forms of use.

This primarily concerns the revision of existing values for soil protection, as well as values in other legal areas with regard to the immission of pollutants and materials into and to the soil in order to ensure a uniform protection level for soils and soil functions. As a result of this revision, the Working Group of the Federal States on Soil (LABO), in co-operation with the Federal Environmental Agency (UBA), submitted a report to the 26th Conference of the Heads of Office (ACK) on 11 and 12 October 2000. This report contains recommendations on the harmonization of soil values, loads and exceptions for reserves. Federal and state governments must develop draft ordinances, technical instructions and rules in order to implement these harmonization recommendations. The expert report by the scientific advisory council on soil protection (WBB) at the BMU (Federal Ministry for the Environment) "Wege zum vorsorgenden Bodenschutz" [Ways for preventive soil protection] [26] mentions further cross-sectional tasks with a view to extended prevention measures within the scope of the Federal Soil Protection and Contaminated-sites Ordinance, such as:

- an amendment to the list of prevention values,
- a restriction of the deposition of air-borne pollutants,
- quality requirements for materials and products used in soils,
- evaluation of soils in the case of land-consuming measures,
- the further development of the criteria of "good technical practice of soil use".

Further cross-sectional tasks include defining testing and measuring parameters for other prioritary pollutants for assessing soils and rehabilitating contaminated sites, developing approaches for the use of rehabilitated areas with the scope of land recycling programmes, as well as developing soil information systems and databases. On 14 June 2000, the Federal Ministry for the Environment set up the advisory council on "soil analyses" at the Federal Environmental Agency (UBA). The main task of this advisory council is to monitor and compile the status of development with state-of-the-art processes and methods for soil analyses. *(II 5.1)*

Ecotoxicological evaluation of soil quality

On the basis of the Federal Soil Protection Act, test and prevention values can be developed to assess the role of microorganisms in the soil for the biosphere. Within the scope of the transforming function – i.e. the decomposition and mineralisation of substances – soil flora and fauna account for up to 80 % of the transformation work in soils. The biosphere of these organisms requires special protection. The following questions should be addressed when developing values for the protection of soil organisms:

- Which ecotoxicological methods are suitable and significant?

Table 5: Substances for which trigger values were defined

4-amino-2,6-dinitrotoluene	*2-ditrodiphenylamine*
2-amino-4,6-dinitrotoluene	*4-nitrodiphenylamine*
1,3-dinitrobenzene	*2-nitrotoluene*
2,4-dinitrodiphenylamine	*3-nitrotoluene*
2,4-dinitrotoluene	*4-nitrotoluene*
2,6-dinitrotoluene	*Octogen (HMX)*
Diphenylamine	*PETN, nitropenta*
Hexyl	*1,3,5-trinitrobenzene*
Hexogen	*2,4,6-trinitrotoluene*
Tetryl	*2,4,6-trinitrophenol*
Nitrobenzene	

- Which reference soils must be used in order to identify the influence of soil properties on the test organisms?
- Which role do ecotoxicological analyses play within the framework of an evaluation strategy for protecting soil functions?

The following aspects should be generally considered when ecotoxicological action data is to be assessed:

- The test (action) parameters selected must be capable of indicating a disorder condition of central ecological parameters.
- The test (action) parameters should supply an early warning of any short, medium and long-term changes in soil quality.
- Both structural and functional parameters should be selected.
- A comprehensive action analysis designed to identify relevant substance values should combine single-species and multi-species tests, laboratory and outdoor experiments, as well as mathematical models.

A database for describing the effect of pollutants on soil organisms and microbial processes is currently being developed within the scope of the project for the "development of ecotoxicological orientation values for soils". Another aim is the development of a concept for generating trigger values. *(II 5.1)*

The UBA has commissioned the Freiburg-based Research and Advisory Institute for Hazardous Substances (FoBiG) with the "development of trigger values for selected historical pollutions at military waste sites" [27]. Trigger values for the soil/human path of action are proposed for 21 compounds that are typical for explosives in accordance with the Federal Soil Protection and Contaminated-sites Ordinance (Table 5).

The toxicological basis for defining the trigger values are the TRD (tolerable resorbed dose) values for non-carcinogenic effects, as well as statements on the cancer risk of defined doses with carcinogenic effects. TRD values for long-term oral exposure are not available for seven of the 21 substances. It was possible to estimate three of these values on the basis of toxicological observations. In the case of another four substances, the assessment values for their effect on soils are only inadequately backed because of insufficient data material. The values calculated by the methods stated were subjected to plausibility checking from the point of view of practical application before the final, plausible trigger values were fixed. *(II 5.3)*

Distribution and action of chromium in soils

When the prevention values for chromium (Cr) were developed during the course of preparing the Federal Soil Protection and Contaminated-sites Ordinance, it was assumed that the Cr(III) to Cr(VI) ratio did not exceed 10:1. Cr(VI) is 1,000 times more toxic than Cr(III). In order to consider distributions of this kind, and in order to secure the definition of trigger values, the UBA commissioned the Fraunhofer Institute for Environmental Chemistry and Ecotoxicology, Schmallenberg, with a research project on the "distribution and action of Cr(VI) by the example of soils with different exposure levels".

The aims of this project are:

- Evaluation of the boundary conditions for determining soluble Cr(VI) in soils in accordance with the DIN 19734 standard, and examination of the applicability to typical chromium-polluted soils
- Performance and evaluation of an intercomparison programme for examining the reproducibility of the DIN 19734 standard
- Characterization of the biological effectiveness with a view to the Cr(VI) content which can be measured in accordance with DIN 19734.

Experiments with chromium-polluted soils showed that the presence of manganese (IV) oxide can cause

oxidation of chromium (III) – however, only if fresh chromium (III) is added rather than the chromium (III) already adsorbed (existing) in the soil. This confirms reports by other authors and suggests that augmentation tests with chromium (III) solutions are a sensible supplement for determining the chromium (VI) content because they enable statements concerning the potential for forming new chromium (VI) in the soil by oxidation of chromium (III) immissions into the soil. In order to analyse the correlation between the chromium content according to DIN 19734 and the biological effect, ecotoxicological reports were made for two uncontaminated soils which were incubated with chromium (VI) at the beginning of the test. The effect on plants, earthworms and microorganisms was studied. A clear relationship between dose and effect was found.

The following action data was determined (the first number relating to the dry weight of sandy, the second number to clayey soils):

- Beet: EC_{50} (inhibition of biomass formation after 14 days): 5 milligrammes per kilogramme (mg/kg) and 3 mg/kg;
- Oats: EC_{50} (inhibition of biomass formation after 14 days): 36 mg/kg and 35 mg/kg;
- Earthworm: LC_{50} (number of animals after 14 days) 5 mg/kg and 15 mg/kg;
- Microorganisms: EC_{50} (ammonia oxidase activity 4 hours; after 14-day incubation of the soil with chromium (VI)): 1 mg/kg and 3 mg/kg.

The action data shows that the biosphere function of the soil is only ensured by the trigger values so far defined under the Federal Soil Protection and Contaminated-sites Ordinance (30 to 100 mg/kg total chromium of which 10 % potentially in the form of chromium (VI) if an assumed chromium (III)/chromium (IV) distribution ratio is given. There seems to be a need to develop a separate trigger value for chromium (VI) in order to address in particular soils with high chromium (VI) contents and low total chromium contents [28]. *(II 5.1)*

Rehabilitation of contaminated sites and land recycling

In order to determine how many derelict sites exist in cities, the UBA commissioned the working group of WCI, Wennigsen und focon, Aachen, with a research project to this effect. This was the first project to register derelict sites, i.e. sites not used or insufficiently used for urban development, in Germany [29].

Based on a three-stage polling cycle at the level of federal-states, municipalities and property under private and public management (commercial properties of Treuhand-Liegenschaftsgesellschaft, derelict rail properties, former military properties), the following result was extrapolated as a result of the project: derelict sites relevant for urban development total 128,000 hectares (ha) throughout the Federal Re-

A total of 128,000 hectares (ha) derelict sites throughout Germany. (Photo: UBA/Hagbeck)

public of Germany. This corresponds to one and a half times the area of Berlin. Given an unchanged land consumption of 129 hectares – corresponding to 200 football pitches – a day in 1999, it is obvious that action is needed in the interest of sustainable development (refer to chapter 3). It appears to be urgently necessary to promote land recycling, i.e. the re-use of derelict areas, in contrast to "greenfield construction".

Within the scope of this project, the soil value balance that had been developed by an earlier UBA project [30] was tested in municipal practice. The soil value balance is the first instrument to combine the costs and immediately capital-effective values of land development programmes with effects relevant for society. This balance quantifies the different qualities of sites from the point of view of municipalities and investors, as well as their relevance for ecology, urban construction and regional development. The soil value balance was introduced at a municipal level in the cities of Goslar, Bad Harzburg and Langelsheim. The practical test turned out to be very successful. All the three municipalities were about to make decisions concerning land use where either virgin land or derelict sites could be classified as construction sites. The evaluation results partially led to a correction of the original plans. The final report is available on the Internet at www.umweltdaten.de/altlast/web1/start. *(II 5.3)*

Erosion: *A process where soil particles and substances attached to them are removed from the soil structure, transported and re-deposited by rain, water or wind. All the sub-processes – i.e. removal, transport and depositing – can occur at the same place during an erosion event.*

Remote sensing: *The recording or measuring of objects without physically contacting them, as well as the evaluation of data and images thus obtained. This process supplies quantitative or qualitative information on the occurrence, the condition or a change in status of the objects in question which can be land, land structures, bodies and substances of the earth and its atmosphere. This includes forests, other plant populations, landscapes and their individual constituents, such as soil. Different recording media are used, including electromagnetic or acoustic waves or fields of forces, as well as different sensor systems (cameras, filters, films on board aircraft; radar antennas and electronic equipment in remote sensing satellites).*

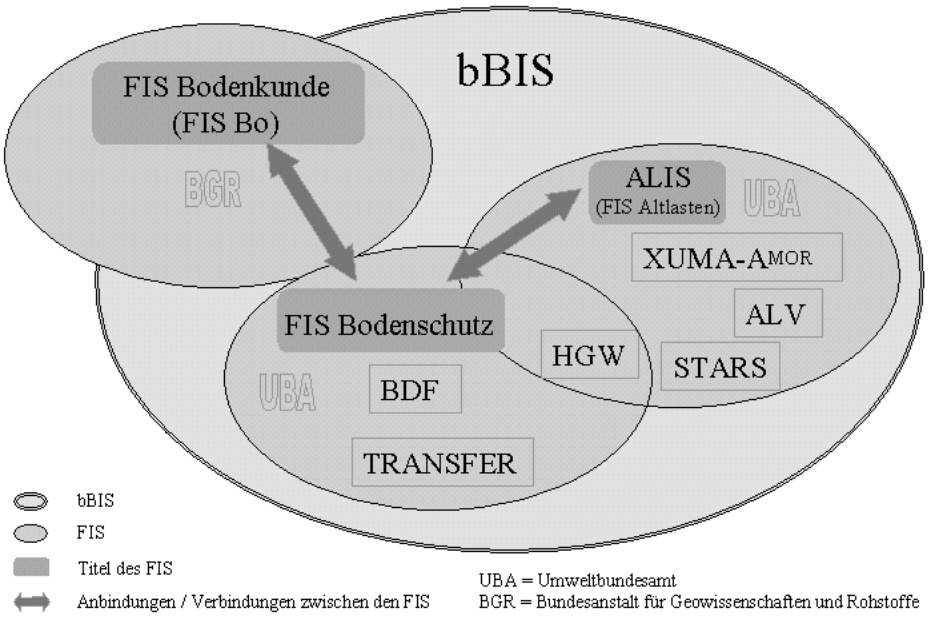
Soil protection and agriculture

Besides exposure to heavy metals and plant protection products, it is, above all, the exposure of soils to non-material burdens that can adversely affect soil functions and hence trigger harmful soil changes. One particularly important aspect is anthropogenic **EROSION** and soil compaction. Soil erosion not only affects on-site fertility. The transport of soil material and substances attached to it can also cause serious damage to neighbouring ecosystems and structures. This leads to so-called off-site damage: exposure of waters to phosphorus, plant protection products and nitrogen, as well as damage to structures, such as pipelines, trenches, locks and bridges. As land use is becoming more intensive, soil erosion caused by water and wind is increasing substantially. This is demonstrated by the maps of potential and actual erosion hazards which were recently prepared by several states for their complete territories.

The technical committee on "soil erosion" at Bundesverband Boden (BVB) is currently in the process of developing a comprehensive study, specifically related to data acquisition methods. Even now, one can already say that the effects and extent of erosion have so far been underestimated in Germany. Another technical committee at BVB on "combating soil erosion by water" is to submit its recommendations and a plan of action by the end of 2001 which can serve as a basis pursuant to Article 8 of the Federal Soil Protection and Contaminated-sites Ordinance.

However, prevention is the only way to ensure sustainable protection of soils against erosion by water and wind. Besides immediate risk avoidance, this should be the main focus of action. The aim is to minimize erosion by sensible soil use, in particular, in agriculture. Article 17 of the Federal Soil Protection Act provides that the agencies which are responsible for this task under the laws of the federal states have to disseminate this message in their consultancy work. In order to define in detail good technical practice, the Federal Ministry of Consumer Protection, Food and Agriculture set up a working group which developed a guideline for action that was published in the Federal Gazette. This paper contains comprehen-

Figure 13: Nation-wide soil information system (bBIS)



BDF = Datenbank zu Dauerbeobachtungsflächen, TRANSFER = Datenbank zur Ableitung von Transferfaktoren Boden – Pflanze, HGW = Datenbank Hintergrundwerte im Boden

sive prevention measures and strategies. The UBA is involved in this working group. *(II 5.2)*

Data for soil protection

Reliable, nation-wide data on the use and condition of the soil is vital: its availability, provision and evaluation are the basis for political decisions and for the definition of priorities in soil protection. This data is needed in order to monitor the success of landscape and regional planning, infrastructure policy, as well as agricultural and nature protection policy.

Land use statistics or the mere accumulation of planning data alone are not enough. REMOTE SENSING as an integral part of geoscientific research and exploration can be used on a broad base. Its crucial advantage is that any region can be covered quickly, up-to-date and on a region-wide level. Remote sensing should, however, always be regarded as a sensible supplement rather than as a substitute for traditional mapping methods.

How can this method with its continuously improving sensing possibilities be used to gather soil-relevant data? Bosch & Partner, Bergisch Gladbach, and Remote Sensing Solutions, Munich, looked into this matter on behalf of the UBA.

To this effect, they identified the pedological basis and prioritised fields of action for soil protection and used these as a basis for developing remote sensing requirements. Furthermore, the basis and methods of remote sensing, as well as basic elements of global positioning systems (GPS), geographic information systems (GIS) and precision farming were explained. The latter term refers to the area-specific farming of large agricultural complexes, with soil working methods, sowing and fertilizing schemes being precisely adapted to the particular piece of land. The authors compared soil protection requirements and the latest technical possibilities and identified restrictions for remote sensing for soil protection purposes. The cost element is also addressed here.

In order to strengthen remote sensing for soil protection and other applications, recommendations are given for operators and users of remote sensing systems, as well as for public administrations in order to eliminate existing obstacles to their use. The measures to this end include the standardization of infor-

mation systems in order to enable the exchange and hence the multiple use of data. Practical implementation is now planned within the scope of demonstration projects. *(II 5.2)*

Nation-wide soil information system

The nation-wide soil information system (bBIS) is being developed by the UBA. This computer-based soil protection tool is made up of the classical elements of an information system. It comes with functions and modules for gathering, storing, processing, evaluating and presenting soil-relevant information. The creation of a nation-wide soil information system (Figure 13, page 77) is designed to assist the gathering, presentation and evaluation of information on soil functions, soil condition, soil pollution, as well as immissions and emissions of substances. The nation-wide soil information system is made up of three specialist information systems (FIS) addressing soil-related issues. These are at present the pedology information system (developed by the Federal Institute for Geosciences and Natural Resources, BGR), the contaminated sites information system (ALIS, developed by the UBA) and the soil protection information system (also developed by the UBA). Another tool is the basic information on soil protection on the Internet. The soil protection information system (UBA) accounts for the largest part of the nation-wide soil information system which features a kernel and reference structure for the management of soil-relevant data at the UBA. This kernel and reference structure makes it possible to link up with other specialist information systems, as well as to communicate with the technical information systems of the federal states and other federal authorities.

The "nation-wide soil information system (bBIS)" project is implemented in several parts. As each part is completed, further functions of modules of the nation-wide soil information system are finalized and integrated into the information system.

The data of the nation-wide soil information system in the Environmental Data Catalogue (UDK) are available on the Internet at www.umweltdatenkatalog.de. *(II 5.2)*

[26] Bundestag publication 14/2834 dated 25 February 2000.

[27] The report is published as a supplement to the handbook "Berechnung von Prüfwerten zur Bewertung von Altlasten" [Calculation of trigger values for evaluating historical pollutions] (editor: UBA), Erich Schmidt Verlag, Berlin, available at bookstores.

[28] The research report can be lent from the library of the UBA under the number: 000119 (address on page 94). It will be published in the TEXTE series, and will be available from Werbung + Vertrieb (address on page 94).

[29] The final report can also be taken out on loan from department II 5.3 of the UBA (address on page 94). The results of the practical trials with the soil value balance, as well as the tools developed for its implementation, are published in German and English. Free copies of this brochure are available from department II 5.3.

[30] "Altlastensanierung als Grundlage für die Erschließung von Freiflächen? Gegenüberstellung und Bewertung von Erschließungsvarianten" [Rehabilitation of contaminated sites as a basis for developing free spaces? Comparison and assessment of development variants], TEXTE 15/98, available from Werbung + Vertrieb (address on page 94).

11. Safety of chemicals and biological safety

Overview

- Introduction
- POPs – a focal issue of international chemical safety
- POPs in the assessment and control of air quality
- Evaluation of chemicals in the EU: more efficiency needed
- Criteria for the environmental assessment of biotechnical processes
- Better protection against the risks of genetically modified organisms

Introduction

At the United Nations Conference on Development and the Environment in Rio de Janeiro in 1992 (refer to chapter 3), almost all the countries of the world agreed to the concept of sustainable, i.e. permanently environment-compatible, development. This includes a broader base and an acceleration of the international assessment of risks posed by chemicals, as well as improved risk management. Special importance is attached to prevention in conjunction with the production and use of hazardous substances. However, a look at European chemical policies over the past two decades reveals that this aim was not reached in general. More than 100,000 chemicals are registered, but just 41 chemicals with high production and marketing volumes have been evaluated in more detail so far. In the case of most substances, it is not possible to evaluate the risks for the environment, for consumers and for the working population. This is due to a lack of data, in particular, with regard to long-term effects and exposure. A complex administrative procedure prevents prompt action when a risk looms. In the year 2000, intensive work was carried out on developing the fundamentals of a more effective European chemicals policy.

POPs – a focal issue of international chemical safety

Persistent organic pollutants (POPs) are chemicals with a persistent character in the environment and which additionally accumulate in organisms (bioaccumulation), which are toxic for humans and for the environment and which are propagated over long distances in the air or in water. Commonly known POPs include chloropesticides – such as aldrin or heptachlorine – as well as chemicals, such as hexachlorobenzene. A process called „global distillation“ causes many POPs used in warmer zones to be transported by the wind to the poles where these substances condensate. This “cooling-finger effect” – comparable to condensation on a cold glass pane – leads to high concentrations of such substances as chlordane and polychlorinated biphenyls (PCBs) in the bodies of polar bears and seals, but also in mother’s milk.

As a first international step towards limiting these risks, the POP protocol was adopted in 1998 for Europe and North America within the scope of the *UN-ECE Convention on Long-range Transboundary Air Pollution (LRTAP).* (UN-ECE being the United Nations Commission for Europe). This protocol addresses 16 substances which – with a few country-specific and application-specific exceptions – are no longer produced or used or the emissions of which should be minimised if these substances are undesired by-products.

When the POP protocol was adopted, negotiations for a global *POP Convention* started in 1998 with an initial twelve substances. This reflected the fact that these substances, which were mostly already banned in industrialised nations, are still frequently produced and used in less developed countries. These negotiations, which were intensively accompanied by the Federal Environmental Agency (UBA) at a technical level, came to a successful end on 10 December 2000 in Johannesburg (South Africa) when a draft convention was agreed to.

Under this draft convention, the contracting parties agreed to ban the production and use of nine deliberately produced POPs within certain transitory periods. The draft convention does not contain any pro-

Table 6: Substances of the international POP conventions

The international UNEP (draft) and UN-ECE conventions list the following POPs:

Aldrin
Dieldrin
Endrin
Chlordane
Mirex
DDT
Heptachlorine
Hexachlorobenzene (HCB)
Toxaphen
*Hexabrombiphenyl**
*Chlordecon**
*Hexachlorocyclohexane (HCH)**
Polychlorinated biphenyls (PCB)
*Polycyclic aromatic hydrocarbons (PAH)**
Dioxines (PCDD)
Furanes (PCDF)

* *in the UN-ECE POP protocol only*

visions for the elimination of DDT because this insecticide is an indispensable agent for fighting malaria in some, particularly African, countries. Furthermore, all the countries undertake to reduce their emissions of undesired by-products, such as polychlorinated dioxins and furanes, and additionally to use state-of-the-art equipment for new sources of such substances. In Germany, for example, emissions from waste incineration plants have already been drastically reduced. The only major sources of emissions are the iron and steel producing industries and sintering plants, as well as the non-ferrous metals industry. Waste must be disposed of in an environmentally compatible manner and the POP content must be destroyed, whenever possible.

The draft convention also provides a procedure for adding further substances with comparable properties. To this effect, criteria were developed which will also be important for the further development of the European assessment programme for chemicals. Further candidate substances are, in particular, pentachlorophenol (PCP) which is still a major source of dioxin, as well as polybrominated diphenyl ethers (PBDI) because they demonstrate a similar environmental behaviour and because they were found in increased concentrations, for example, in the Environmental Specimen Bank of the Federal Government (refer to Part 2, page 123).

The precautionary principle was explicitly included in the draft convention because it is not always scientifically certain that a substance meets with all the criteria of the convention. Furthermore, governments are to ensure within the scope of their national substance assessment programmes that substances with a POP potential are identified and "subject to regulation for the purpose of being avoided". This is a requirement which has yet to be implemented in European legislation on chemicals. *(IV 2, III 2.3)*

POPs in the assessment and control of air quality

POPs are also among the prioritary substances of the two international conventions for the protection of the marine environment, i.e. HELCOM for the Baltic region and OSPAR for the North East Atlantic region (refer to chapter 1 for details). The measures and monitoring programmes implemented within the scope of these conventions hence also aim at reducing POP immissions.

Emission reduction measures are monitored by model calculations, as well as tried-and-tested monitoring programmes for pollutant immissions. On a voluntary basis, the signatory states measure the chloropesticides, polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) which are important for the air path. The only substance for which OSPAR includes a binding measurement obligation in wet precipitation is lindane. At the Zingst and Westerland stations, the UBA has been measuring the precipitation contents of PCB and chloropesticides since 1992 and of PAHs since 1995. This data is reported to the secretariats of both conventions.

The need for a harmonized monitoring strategy in Europe is increasingly being discussed. Germany was asked by OSPAR to accept the technical responsibility for harmonising PAH measurements. In co-operation with NORDUM GmbH, Keffin/Rostock, the UBA has compared collecting equipment and analyses of the measuring stations in six OSPAR states. The results were evaluated by an international workshop, and have become the basis for a handbook on methods published by the OSPAR secretariat [31]. *(II 6.4)*

Control of chemicals in the EU: more efficiency needed

Control of chemicals in Europe is undergoing a re-orientation process: based on the conclusions of the EU's Council of Ministers from June 1999, the contents of a new chemicals policy were developed in the year 2000 which were then reflected by the EU Commission's white paper on the "Strategy for a future chemicals policy" in February 2001.

The UBA has taken part in this discussion on the new strategy by contributing its 20-year experience in the fields of risk assessment and development of risk reduction measures both for **NEW SUBSTANCES** within the scope of the *chemicals law* and **EXISTING SUBSTANCES** within the scope of the *EU directive on existing substances*.

The introduction of an approval requirement for particularly hazardous substances considered in the EU white paper has for many years been proposed by the UBA in the interest of effective and efficient management of chemical substances because this would force manufacturers to prove the harmless nature of such substances for certain applications. This central element of future chemical control policy promotes responsible, active participation by the chemical industry. [32]

A subset of the particularly hazardous substances are so-called PBT (persistent, bioaccumulating, toxic) substances which are persistent in the environment and accumulate in organisms, for example, in fatty tissue. Despite many international attempts to stop the use of these substances with their environmentally hazardous properties, the EU Commission exempted them in its white paper from the approval requirement for particularly hazardous substances. In the event that an approval requirement for these particularly environmentally relevant substances cannot be achieved during the ongoing debate, all the persistent and bioaccumulating substances should be immediately subjected to a so-called prioritising process as a minimum requirement. As a result of such an exercise, classification, for example, as a "potential PBT substance" would take place and a test programme would be adopted for the prompt clarification and reduction of the environmental risk.

The crucial point for the practical implementation of the approval process for particularly hazardous substances will be the criteria used to selection "suspicious" substances at the registration level and at the subsequent evaluation level. The focus of this issue is different for existing and new substances.

In the case of existing substances, the process must be concretized in a suitable manner in order to ensure that the decision-making process is not unreasonably delayed by requests for additional information. With the current system of handling this issue, reluctance on the part of the chemical industry to supply the required data often delays the completion of assessments and hence the implementation of risk reduction measures.

The question in the case of new substances is which data will be generally available as a basis for investigations into suspected cases. Particularly in the case of substances produced in small quantities, there is a major risk that the scientific basis will be too weak to justify investigations into suspected cases and hence to request further data. It is hence vital that a practical, technically justified balance be found between a waiver of probably superfluous data on the one hand and requests for additional, probably necessary data on the other. Suitable strategies must be urgently developed for a reliable and efficient selection of critical substances from this vast number of substances, based on a minimum scope of available information and data, in order to rule out that these substances can become a cause of future problems.

One difficulty which the UBA sees is that these substantial improvements in handling existing substances are taking place at the expense of major restrictions for new substances in the registration systems that is in fact currently quite successful. A major share of these new substances so far fail to reach the volume threshold of ten tonnes per year where the complete set of basic data must then be submitted pursuant to the EU Commission's proposal (at present: one tonne).

Existing substances: *Substances that were marketed before 18 September 1981 and which are included in the European Inventory of Existing Commercial Substances (EINECS).*

New substances: *Substances that were marketed for the first time in the EU after 18 September 1981.*

One of the arguments for the de-facto dissolution of the present new-substances system put forward by the chemical industry is that this would release resources at evaluating institutions. However, this argument loses impact when this is correlated with the demand for resources which would arise when existing substances are to be included. Furthermore, the costs of the analyses for a first assessment of the environmental risk which are currently required are also relatively low, no matter what the chemical industry claims. The risk of serious obstacles to innovation in the chemical industry appears to be low in a flexible system.

Reproducible and effective risk assessment requires all relevant information and data – including data gaps – to be fully disclosed by the manufacturers. This requirement includes not just active data, but, first and foremost, also significant and substantiated exposure data, for example, as requested in the questionnaire by the Organization for Economic Co-operation and Development (OECD). This questionnaire contains a list of data that is vital for reliable exposure assessment. The tailor-made test plans implemented on this basis prevent data graveyards and superfluous experiments on animals. However, evaluation experience so far suggests that evaluations made under the industry's own control seldom meet with the requirement of far-reaching transparency. Most of these studies lack sufficient exposure data, especially for the so-called "downstream users" of chemical substances. Work performed under the manufacturer's exclusive control should hence primarily focus on a transparent presentation of all the necessary data. The white paper is, however, lacking in terms of provisions for suitable remedies in cases where data material is not supplied on time.

The UBA appreciates very much that downstream users are to be included in chemicals management procedures. According to the white paper, the chemical industry is to be obliged to disclose data and initial evaluations for those applications of substances which have not yet been addressed in the risk assessment by the manufacturer or by the party bringing these substances into circulation. Lack of knowledge concerning patterns of use of substances and the resultant exposure has so far often impeded and delayed substantiated risk assessment. The further design of a chemicals policy should concentrate on a fair distribution of burdens and obligations between manufacturers and users of substances.

Against the background of intensive debate over recent years, and in view of the corresponding resolution by the European Parliament, the UBA is of the opinion that the white paper fails to adequately address the treatment of substances with an endocrine, i.e. hormonal, mechanism of action. *(IV 1.1, IV 1.2)*

Criteria for the environmental assessment of biotechnical processes

The repercussions of industrial processes on man and the environment can be evaluated in several ways (refer also to chapter 8). In initial approaches, these were also applied to biotechnology. One of the most important methods for integrating environmental aspects into the evaluation and design of industrial products and processes is the life cycle assessment approach. In view of what is currently still a weak data base for biotechnical production processes, it is at present hardly possible to fully assess the life cycles of biotechnical processes, including material balance, effect assessment and evaluation (pursuant to the international ISO 14040 to 14043 standards). It is hence only possible to generate abridged life cycle assessments, which are initially restricted to energy and substance flow analysis tools, as well as risk assessment of base materials, intermediate and end products. The risks caused by the organisms involved must also be considered in this context – particularly if these organisms are genetically modified. Furthermore, if a biotechnical process promises ecological benefits, obstacles to their introduction must be analysed and suitable strategies developed to overcome them.

The potential offered by biotechnical processes for easing environmental burdens compared to chemical/technical alternatives in the chemical industry were determined by the company Prognos AG, Basel, Switzerland, in a comparative, ecological impact study carried out on behalf of the UBA. The study chiefly refers to qualitative comparisons based on input and output substances, reaction conditions and further substances involved. It considers categories of action with the aim of protecting human health (humantoxicity issues), as well as the structure and function of ecosystems (ecotoxicity, aquatic and terrestrial eutrophization, use of natural spaces, photochemical oxidant formation, decomposition of ozone in the stratosphere, greenhouse effect, acidification). It was found that biotechnical processes for producing basic

and fine chemicals are often environmentally more favourable than chemical/technical synthesis.

The Organization for Economic Co-operation and Development (OECD) has set up a working group with UBA participation that is working on the development of a simple evaluation instrument specifically for biotechnical production processes. This is to supply a preliminary evaluation and decision-making aid during the planning phase of industrial biotechnical processes because decisions in this field must often be made at a very early stage of development. The following categories are being discussed as main evaluation aspects:

- Reduction of energy use
- Reduction of raw material consumption and waste production
- Types of raw materials used
- Use of by-products
- Product and process safety.

In order to increase the base of evaluation-relevant data of biotechnical processes, future research projects in the field of biotechnical processes will have to focus more on identifying the specific project's contribution towards sustainable development (refer to chapter 3). Statements concerning the balancing of the internal material and energy flows in the manufacturing plant should be included to this effect. Research projects meeting with this requirement are promoted by the UBA, the Federal Ministry of Education and Research (BMBF), as well as the German Federal Foundation for the Environment (DBU).

(III 1.1)

Better protection against the risks of genetically modified organisms

In order to adapt the legal basis for the release and placing on the market of genetically modified organisms (GMOs) to the latest level of experience and science, as well as to changed conditions in the society, the EU Environment Council resolved in July 1999 to amend the *EEC Directive on the Deliberate Release of GMOs (90/220/EEC)*.

In 2000, agreement was then reached on the contents of the new *2001/18/EU* Directive which were adopted by the European Parliament and the Council of Europe in February 2001. The new EEC Directive on the Deliberate Release into the Environment of Genetically Modified Organisms must be implemented as national legislation by the EU member states within 18 months after publication. This directive will lead to a significantly improved safety, for example, by limiting the term of approvals and by avoiding antibiotic resistance marker genes. Furthermore, marking and tracing provisions for GMOs and a public cultivation register contribute towards more transparency for consumers. Apart from this, approved organisms will be subject to monitoring. Much higher priority is attached to the precautionary principle.

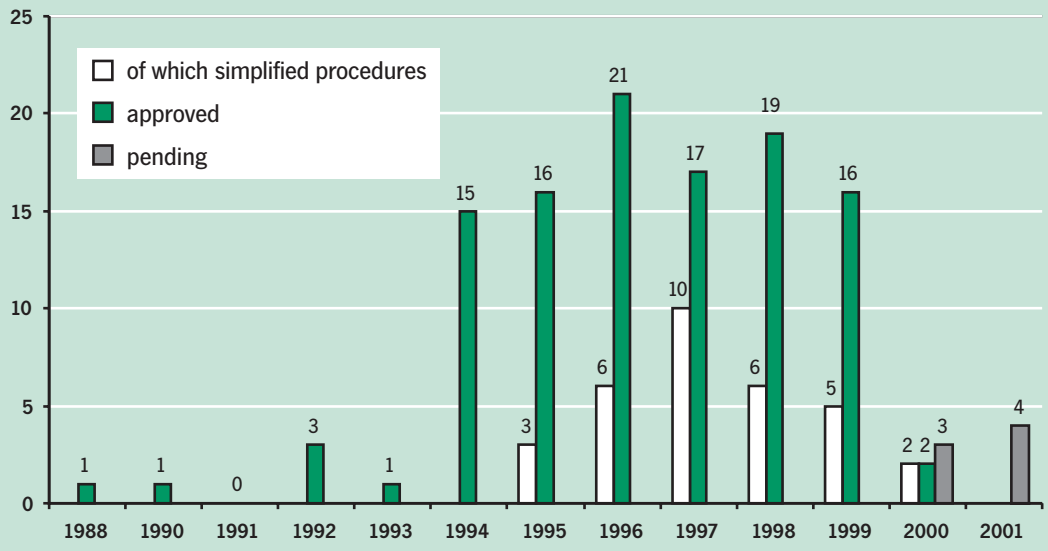
For some time now, the UBA has been involved in GMO monitoring for which EU-wide provisions are now in place. The technical focus of this effort is the monitoring of genetically modified plants (GMPs). In co-operation with Federal State governments, the UBA has developed a position paper for the Conference of Environmental Ministers. This will form the basis for evaluating, amending and continuing the pilot projects that were launched in 2000 together with the Federal States. Another focal point of the UBA's work is to improve the basis for assessing the environmental implications of the cultivation of genetically modified plants. One central issue in this context is the risk caused by insecticide-resistant maize (corn) containing a toxin from *bacillus thuringiensis* (b.t. maize), by genetically modified shrubs, as well as questions of gene transfer with the involvement of birds and insects.

Figures 14 and 15 show the number of approved cases of release in Germany and the number of EU-wide applications. *(IV 2.5)*

Protocol on biosafety

The Protocol on Biological Safety was adopted in Montreal on 29 January 2000 following difficult negotiations. This global convention contains provisions for the safe dissemination, handling and use of genetically modified organisms. It is the first document that controls trans-border trade. Exports are only permitted if the recipient state receives detailed advance information on the risks related to traded GMOs and agrees to their import. Furthermore, trade regulations are to be developed within four years after the coming into effect of the protocol. Within two years, concrete provisions are to be developed for the labelling and identification of products containing GMOs and which are directly used as food for human or animal

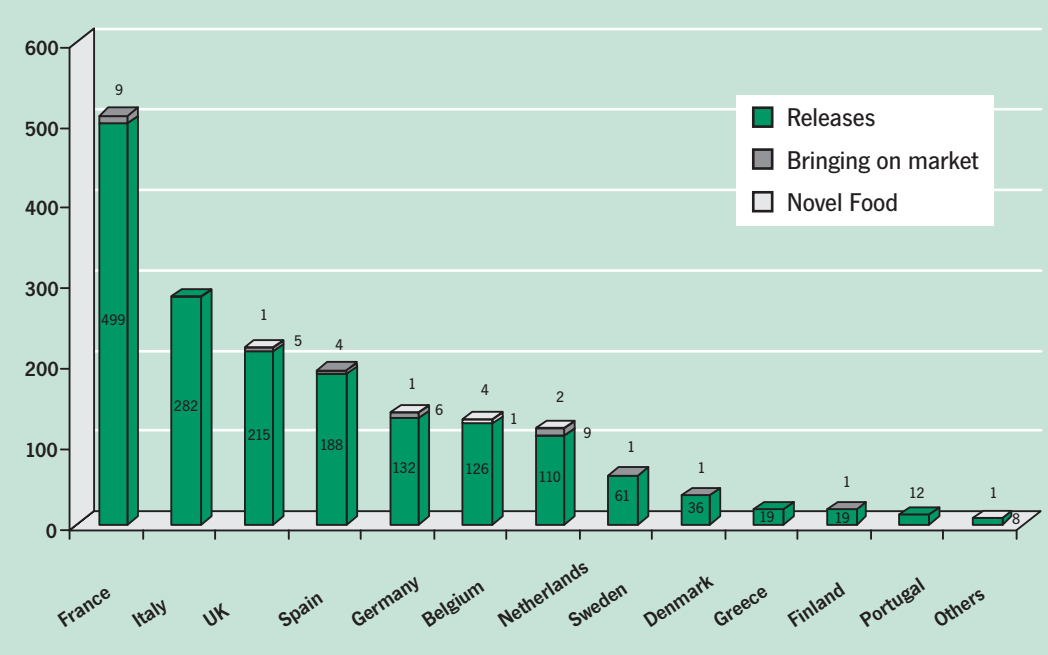
Figure 14: Number of releases in Germany approved since 1988



consumption or which are designed for further processing. It is a remarkable fact that the language of this international convention explicitly refers to the precautionary principle. Although socio-economic aspects are to be addressed too, the protocol does not explain what this means in detail. It explicitly refers to local population groups. These and historically grown agricultural structures, specifically in less developed countries, are to be respected.

The history of the protocol dates back to 1995. The Second Conference of the Parties to the Convention on Biological Diversity in Jakarta (Indonesia) resolved to prepare a protocol on biosafety. The ensuing ne-

Figure 15: Number of applications for placing on the market EU-wide



gotiations on the protocol were long and tedious due to unresolved conflicts between environmental and trade regulations. Shortly before the completion of the protocol, this convention was exempted from the rules of the World Trade Organization (WTO). This marks a victory for environmental policy with implications far beyond the scope of the protocol.

The Protocol on Biosafety was signed by 68 states, among them Germany, during the Fifth Conference of the Parties to the Convention on Biological Diversity in Nairobi, Kenya, in May 2000. 90 days following ratification of the protocol by the fiftieth state, it will become binding international law. This is expected to happen in 2002.

The implementation of the protocol requires far-reaching preparations by all the signatory states. The Intergovernmental Committee for the Cartagena Protocol on Biosafety (ICCP) was set up and met for the first time in December 2000 in order to support the implementation process. Focal issues of this first meeting were procedures for exchanging information and support for less developed countries through international expertise and financial assistance ("capacity building"). Concrete definitions were drawn up for the planned pilot phase for exchanging information. In this context, it must be ensured that particularly those countries will be involved on an equal-rights basis that do not yet have access to the necessary technical basis, such as Internet access. The UBA was involved in the negotiations on the Protocol for Biosafety and attaches a great deal of importance to the implementation of the protocol in the interest of the international harmonization of the assessment and handling of GMOs. In Germany, the UBA is participating in the creation and establishment of the information system in the form of a database which will provide information to users at an international level on legislation and evaluation of environmental impacts of GMOs, as well as comments within the scope of the national approval process. *(IV 2.5)*

[31] "Pilot Study and Intercomparison Exercise on Atmospheric Inputs of PAHs", available as a PDF document on the Internet at www.ospar.org.

[32] For details concerning the requirements for a new approach to controlling chemicals, please refer to "Nachhaltigkeit und Vorsorge bei der Risikobewertung und beim Risikomanagement von Chemikalien" [Sustainability and prevention in conjunction with risk assessment and risk management for chemicals] (TEXTE 30/01). This document is available from Werbung + Vertrieb (address on page 94).

12. Material flows and recycling management

Overview

- Introduction
- Material-flow-related waste policy
- Revision of the packaging ordinance
- Drafting an ordinance for recycling old and used wood
- Recycling CRT and light-bulb glass
- Status of used tyre recycling
- Mechanical-biological treatment of residual waste

Introduction

Over the past 25 years, the German waste sector has persistently moved away from being a throw-away and dumping economy to becoming an integrated waste sector that focuses on waste avoidance and recycling. Since it became ever more clear not just in the case of waste disposal but even more so in the case of waste recycling that the treatment adopted depends on the method of production and product properties, a comprehensive approach of recycling and waste management was selected. The *Waste Avoidance, Recycling and Disposal Act* added the term product responsibility to the aforementioned terms.

Within the scope of a holistic recycling management approach it is also becoming increasingly clear that the aims of waste avoidance and high-quality and harmless recycling were only reached through the individual assessment of waste and waste handling processes. Despite tremendous efforts, it is still not possible to gain a trans-product and trans-waste view. In order to simplify matters, it does, however, appear to make sense to integrate not just product-related approaches into waste management, but also to increasingly include material flow assessments.

Material-flow-related waste policy

The aim of the Waste Avoidance, Recycling and Disposal Act is to boost the efficient use of resources through greater recycling of products or materials and to reduce the burdens on the environment.

Previous ordinances and drafts – for example, for used cars and electrical appliances – focused almost solely on the final products, i.e. the waste as the object to be controlled. Any influence on the upstream areas of production and use of goods is only possible with the help of the product responsibility provision contained in the law. This product-based approach means that a large number of ordinances is required due to the vast number of products.

Material-flow-based regulations for mass materials also enable environmental burdens to be reduced. This could be an alternative to product-related regulations or could supplement these. A survey carried out on behalf of the Federal Environmental Agency (UBA) by the Institut für Zukunftsstudien und Technologiebewertung (IZT), Berlin, in co-operation with ARGUS (work group on environmental statistics at Berlin Technical University) and the law firm of Schmidt-Wottrich, Jungnickel & Partner, Berlin, analyses the legal possibilities and requirements for material-flow-related waste management measures. The survey examined whether such measures can reasonably supplement or even replace existing or planned product-related regulations. Furthermore, attention was also paid to examining the waste-management application areas and the effects of the concrete measures. For this purpose, all relevant material flows from the extraction of raw materials to semi-finished production, the distribution to the different forms of application right through to the products and their after-life use were examined and the problems found were described.

The study provides a methodical foundation for the expansion of waste legislation with a view to prioritary material flows. They can be taken into account during the further development of a product-related waste policy [33]. *(III 1.1)*

Revision of the packaging ordinance

Based on a decision by the German Bundesrat of 29 May 1998 on the revision of the *Packaging Ordinance*, a work group of federal and state governments was set up in which the UBA is also involved. This decision demands that the current system of collecting and recycling packaging be examined in the medium term in ecological and economic terms and revised when necessary. Guidelines were established in detail for the work group, two of which must be highlighted:

- Packaging that does not make ecological or economic sense should be unattractive from a financial point of view.
- Only packaging where recycling makes sense from an ecological and economic point of view are permitted to be collected by separate collection systems.

One important source of information for the work group is the survey carried out on behalf of the UBA titled "Basic principles for ecologically and economically sound recycling of packaging". This survey was drawn up in co-operation with the work group and carried out by HTP Ingenieurgesellschaft Hoberg und Partner, in Aachen, and the IFEU Institute for Energy and Environmental Research in Heidelberg [34].

As agreed, the survey focused on the content of "yellow sacks" or "yellow bins", the so-called light-weight packaging fraction. In order to evaluate this further, this light-weight packaging fraction is broken down into 13 packaging material groups which are modelled in such a manner that their recycling profiles are approximately the same in each case. Some examples:

- Tinplate packaging
- Milk and juice cartons
- PET bottles
- Plastic foil smaller than DIN A4.

The survey calculates realistic emission and recycling rates on the basis of the sorting and treatment methods used. For this purpose, the authors distinguish between the status quo with sorting systems in 1998 (primarily with manual sorting), an optimised status quo (semi-automated plants) and the fully automated SORTEC plant. Parallel to this, the costs of the different processes were calculated whilst, within the scope of an eco-balancing assessment (refer to chapter 11), the respective ecological benefits achieved were estimated by comparing with a zero scenario. The main results can be summarised as follows:

- All material groups can be more or less recycled – depending on the technology. The requirement for small parts becomes less important the better the sorting system is.
- Recycling costs for plastic materials are particularly high. Although they can be lowered, depending on the process, the disposal option (70 % landfill, 30 % incineration), is always cheaper for all other material groups – with the exception of metal packaging.
- The technology in question is also important for ecological ranking. Basically speaking, recylcing has ecological advantages compared to disposal that are, however, almost insignificant given the status quo of sorting systems for the packaging materials groups of plastic cups, plastic foil smaller than DIN A4, plastic composites and other plastics. More advanced sorting systems are needed in order to gain significant advantages for recycling compared to disposal.

In a final scenario assessment, the authors examined which cost reductions were possible and the resultant impacts if the packaging materials found to be of a disadvantage were not collected and recycled as light-weight packaging, whilst on the other hand the requirements of the Packaging Ordinance and the *EU Directive on Packaging* (recycling rate of at least 25 % or no more than 45 %) are just about adhered to. The results shown in Figure 16 can be summarized as follows:

- It is just about possible to fulfill the rates required under the Packaging Ordinance with the current structure for the gathering and recylcing of light-

Status quo of sorting systems in 1998: packaging garbage sorted manual. (Photo: courtesy of BMU)

weight packaging; this means that removing less suitable packaging would immeditealy lead to a decline below the recycling rate.

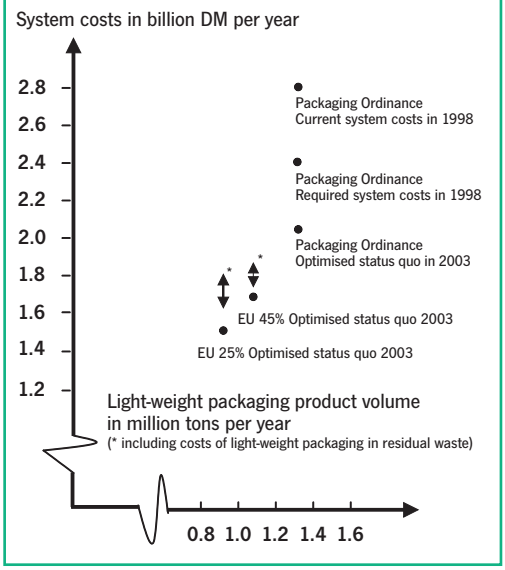
- Even if the contents of the light-weight packaging fraction remains unchanged, cost reductions are already in sight due to technical and contractual improvements which will reduce the costs from currently EUR 1.43 billion a year to around EUR 1.02 billion a year (100 % optimised status quo).
- Moreover, direct system costs can be slightly reduced with smaller recycling quantities (rates required under the EU Directive on Packaging) by excluding indivdual material groups, however, the specific costs for the packaging forms that remain in the system rise at an above-average rate.

In its ongoing work on the packaging ordinance, the work group from government and state governments will not only keep these results in mind, but will also take other aspects into consideration, for example, legal issues, competition problems and other practical questions of consumer protection. *(III 2.5)*

Drafting an ordinance for recycling old and used wood

It is estimated that every year in Germany around 18 million tonnes of old and used wood must be disposed of. This amount includes around 10 million tonnes of industrial wood waste that is generated by the wood processing industries, as well as around 8 million tonnes of used wood that is generated as waste after the useful life. Old wood can contain considerable burdens caused by paint, varnishes and coatings, as well as wood preservatives and flame retardants.

Figure 16: Recycling of packaging



According to the provisions of the Waste Avoidance, Recycling and Disposal Act (KrW/AbfG) that came into force in 1996, priority must be given to recycling waste when it is not possible to avoid generating such waste. Although technical possibilities do exist for material recycling or energy recovery, a considerable amount of old and used wood is still being disposed of at landfills or in waste incineration plants. Large quantities of old and used wood are also being exported for recycling and disposal.

Economic reasoning is primarily the motivation for insufficient recycling and the degree of exportation, however, legal uncertainties in Germany also have a role to play here. Some federal states have in fact issued recommendations and guidelines for the correct disposal of old and used wood but a nationwide approach is still lacking. This holds particularly true when it comes to tolerable pollutants for material recycling in the wood product industry. A recommendation drafted by the Working Group of the Federal States on Waste failed to find widespread acceptance. This is why the federal states requested that the federal government draft standardised regulations.

Within the scope of a joint project by the BMU (Federal Ministry for the Environment), involving the UBA, an *Ordinance on the Requirements for Recycling and Disposal of Old and Used Wood* was drafted. The draft particularly focuses on defining in detail the requirements for harmless recycling of old and used wood.

This draft divides old and used wood into four old-wood categories based in their different pollutant burdens:

- Old-wood category A I: natural wood or wood that has merely undergone mechanical processing and that was not significantly contaminated by non-wood substances while being used
- Old-wood category A II: wood that has been bonded, painted, coated or varnished without organic halogen compounds in the coating and without wood preservatives

- Old-wood category A III: old wood with organic halogen compounds in the coating without wood preservatives
- Old-wood category A IV: old wood treated with wood preservatives, such as sleepers, poles, hop poles, vine poles, as well as other old wood that cannot be assigned to old-wood categories A I, A II or A III due to its pollutants, with the exception of old wood containing polychlorinated biphenyls (PCB).

Old and used wood containing PCB as defined in the *PCB/PCT Waste Ordinance* must be disposed of in line with these regulations. This applies particularly to insulation and sound-proofing panels that have been treated with substances containing PCB.

A detailed list contained in the appendix to the draft ordinance contains the most frequent types of old wood with the respective old-wood category that corresponds to the pollutant burden that can be generally assumed. Operators of old-wood recycling plants must have good reason for deviating from these categories. Generators and owners of old and used wood are obliged to collect and store old wood separately according to source and type or according to the old-wood categories when this is required for the form of recycling planned. The obligation to store separately is particularly relevant for old wood containing PCB that is to be disposed.

The draft for an ordinance on old wood defines three methods of material recycling (recycled wood products, manufacture of synthesis gas, production of activated carbon or industrial charcoal) the old-wood categories approved in each particular case as well as the requirement to be fulfilled. Other methods of material recycling for old wood are not recognized as recycling under this ordinance. Their approval is directly linked with the provisions of the Waste Avoidance, Recycling and Disposal Act.

Recycling wood chips and wood shavings to produce recycled wood products is only permitted when certain pollutant concentration levels are not exceeded. Adherence to these specified limit values in the individual batches is ensured by self-monitoring on the part of old-wood processing plants themselves and is monitored every three months by a body appointed by the supreme federal state administration responsible.

Within the scope of energy recovery using old and used wood, operators of these plants must check sorting results in order to ensure that old and used wood has been sorted according to the categories set forth in the ordinance on old and used wood. In the case of recycling in plants that do not require approval, it must be ensured that no old or used wood is handled that cannot be assigned to categories A I or A II. In order to ensure the environmental compatibility of energy recovery, special imission-protection regulations have been issued for old wood containing mercury (kyanized).

No priorities have been defined for material recycling or energy recovery using old wood, nor has the quality of the recycling methods been ranked. Old and used wood for disposal must be subjected to thermal treatment. This means that after coming into effect, disposing of old and used wood at landfills would be no longer possible, even before the transition period under the Ordinance on Waste Landfills has expired.

Operators of old-wood recycling plants have various recording and registration obligations. These include, in particular, the keeping of a log with delivery documents that state the origin, quantity, category and type of old wood. The results of the plant's self-supervision programme and of monitoring performed by external bodies must also be documented. On request, this log must be submitted to the authority in charge.

In November 2000, a hearing was held with the participating business communities, the municipal umbrella organizations and the federal states on the draft for the ordinance on old and used wood. It is hoped that this will be adopted by the federal government before the end of 2001. The ordinance is then to be directly submitted to the Bundestag and Bundesrat for ratification. *(III 2.5)*

Recycling CRT and light-bulb glass

Around 400,000 tonnes of CRTs must be disposed of each year in Europe, between 70,000 and 100, 000 tonnes of which are generated in Germany alone. Compared to other forms of recycling, environmentally compatible recycling of CRT glass still poses a large number of problems and by far fails to meet the criteria for modern waste management. This is, among other things, due to the fact that much too little old glass is being returned to the production cycle

and instead recycling is being carried out at the very most on the lowest level (for example, in road construction or for filling up abandoned mines).

A colour picture tube comprises the following glass parts: the screen glass, funnel glass and the tube neck glass. The lead-containing parts are particularly relevant for the environment, i.e. the funnel glass (with up to 24 % lead oxide, PbO) and the tube neck glass (up to 30 % PbO) and the frit used to connect the glass components (80 % PbO). In Germany alone, annual consumption of lead oxide for CRT production totals between 25,000 and 30,000 tonnes. Funnel glass, due to its high lead content, may on no account make its way into what is normally lead-free material recycling.

In October 2000, the Working Group of the Federal States on Waste, in which the UBA is also represented, adopted the *Technical Instructions for the Disposal of Old Electrical Equipment and for Setting Up and Operating Plants for the Disposal of Old Electrical Equipment*. These instructions also provide concrete information for the manufacture and recycling of CRT glass and forms the basis for national regulations for the implementation of the *EU Directive on Waste Electrical and Electronic Equipment* that is currently in the making. Discharge lamps, that include fluorescent lamps, compact fluorescent lamps, high-pressure discharge lamps, mercury vapour lamps and halogen metal vapour lamps, require mercury in order to work, between 7 and 30 milligrams (mg) per lamp.

In this context, fluorescent tubes are particularly important. Around 80 million of such tubes are sold every year in Germany. According to the Lamp Recycling Work Group, the recycling rate for these tubes is around 50 %. Reliable methods already exist for recycling used fluorescent lamps where the mercury-containing luminous substance can be almost completely separated from the glass part. In the case of discharge tubes and compact fluorescent lamps, however, mercury is diffused into the glass part over the course of the useful life of the lamp, so that the recycled broken glass can also still have a mercury content of between 4 to 8 mg/kg. It only make sense to recycle this broken glass when it is certain that no mercury can be released or when special measures make it possible to remove the mercury.

The UBA is in favour of the gradual reduction of mercury content in discharge lamps as well as the establishment of a control material recycling system for recycled lamp glass, and also supports the development of alternative, mercury-free lamp systems. The Agency voted in favour of a project application submitted by the German Federal Foundation for the Environment on the “Substitution of mercury-containing UV light sources by electrodeless light sources”.

(III 2.4)

Status of used tyre recycling

A plant for recycling used tyres that was subsidized within the scope of the investment programme at Mülsener Recycling und Handelsges. mbH, in Mülsen St. Jacob, has been in operation for over four years now. Here, thanks to enormous efforts on the part of the operator, it has been proven that used tyres can be successfully recycled to produce useable rubber granules and rubber crumb.

It was expected that this plant would generate a significant impetus for the planning of other used type recycling plants and the development of high-quality recycling. In recent years, numerous used tyre recycling plants have been planned, particularly in the new federal states, and have at times been announced and positively received in specialist titles. However, the majority of these plants were never actually built. Those plants that reached trial or trial operations phase failed to achieve successful continuous operations and have been closed meanwhile. This problem is not due to a faulty or lacking recycling technology, but is rooted in serious planning and management errors and in what is still an unsatisfactory economic setting.

The UBA has repeatedly highlighted the problems of planning and operating plants for high-quality recycling of used tyres, most recently at the German meeting of the European Tyre Recycling Association (ETRA) that was held on 5 December 2000 in Brehna. There is still no comprehensive, national recycling concept for used tyres that is accepted by all partners in the tyre industry and that contains clear information concerning the application of disposal fees for used tyres and the financing of recycling measures.

The impression prevails that planners and potential operators still lack the required technical know-how on used tyres as a raw material, on the required re-

cycling technology and its operation, on product requirements and product marketing and, above all, they still lack the required financial standing. There is also a growing impression that planning documents are not being checked with sufficient care by finance institutes and subsidy bodies.

The UBA is of the opinion that the technology needed for high-quality and harmless recycling of used tyres does already exist. It is, however, urgently necessary that the communities involved reach agreement on a comprehensive disposal concept for used tyres – and above all, on the long-overdue financing concept. This should also ensure that problems, such as unwanted or illegal temporary storage of used tyres, mismanagement of plants and the collapse of companies, are avoided. *(III 2.4)*

Mechanical-biological treatment of residual waste

In the report on the "Ecological feasibility of mechanical-biological pre-treatment of residual waste including its dumping" from July 1999, the UBA recommended ecologically feasible requirements for mechanical-biological waste treatment plants and for the dumping of waste that has been subjected to mechanical-biological treatment. In order to implement these requirements for the environmentally compatible operation of waste treatment plants with legally binding effect, the Federal Ministry for the Environment (BMU) and the UBA have jointly prepared three draft ordinances. In order to ensure the immediate coming into effect following ratification by the Bundesrat, the individual ordinances were compiled in the *Ordinance on environmentally compatible disposal of municipal waste and on biological waste treatment plants.*

The *Ordinance on Waste Landfills* contains requirements for the quality of the waste to be deposited and for landfill operations and contains transition periods for closing old landfills that cannot be brought up to state of the art. The aim of the requirements of the *Ordinance on plants for the biological treatment of waste (30th Federal Emission Control Ordinance)* is to reduce emissions into the air from waste treatment plants to the same extent as with waste incineration plants. The ordinance amending the *Directive on Sewage* will contain an additional appendix 23 dealing with waste treatment plants as a source of sewage.

The ordinance comprising the three individual ordinances came into effect on 1 March 2001. With these new ordinances, important aims of the *Technical Instructions on Municipal Waste (TASi)* – for example, for the completion of the disposal of untreated waste by 2005 at the latest – have now be put into a legally binding context. In addition to the Technical Instructions on Municipal Waste, assignment criteria are also defined for the environmentally compatible disposal of waste that has undergone mechanical-biological treatment. Apart from waste incineration, technically high-quality mechanical-biological methods will also be permitted in future for residual waste treatment plants. Setting final deadlines for the operation of obsolete old landfills means that the requirements of the *EU Directive on Old Landfills* are already being fulfilled. *(III 3.3)*

[33] The final report "Machbarkeitsstudie für eine stoffstrombezogene Abfallwirtschaftspolitik" [feasibility study for a material-flow-related waste management policy] can be taken out on loan free of charge from the UBA's library (address: see page 94). It is published in the TEXTE series and available from Werbung + Vertrieb.

[34] The report can be taken out on loan from the UBA's library (address: see page 94) under No.: FKZ 298 33719. It is also available on the Internet at: www.umweltbundesamt.de.

UBA Annual Report 2000

Part 2

Project results, data and news

Department I: Environmental planning and environmental strategies

Division I 1:

Environmental strategies and environmental information

Environmental Research Plan (UFOPLAN)

The Environmental Research Plan (UFOPLAN) by the Federal Ministry for the Environment (BMU) includes the need for research derived from the different tasks in the fields of environmental protection, nature conservation, as well as reactor safety and radiation protection. The key aspects of the projects commissioned by the Federal Environmental Agency (UBA) – rounded off in percentage shares of the research budget handled by the UBA in 2000 – can be found in figure 17. Furthermore, projects are also commissioned by the Federal Nature Conservation Agency (BfN) and the Federal Office for Radiation Protection (BfS).

The UFOPLAN Environmental Research Plan is published every year – usually in early December – for the coming year on the BMU's (Federal Ministry for the Environment) homepage on the Internet (address: www.bmu.de). The UBA also publishes the part applicable to its field of work on the Net (www.umweltbundesamt.de). These publications form the foundation for the awarding procedure based on competitive aspects. The Federal Tender Gazette also refers to the UFOPLAN. *(I 1.1/Z 1.6)*

Comprehensive reports and background information on many of the topics are also available. Information material published by the Federal Environmental Agency can be purchased from the company Werbung und Vertrieb, Ahornstraße 1–2, 10787 Berlin, Germany, telephone: +49 30/2 11 60 61, telefax: 2 18 13 79. Free material is available from the UBA's Central Answering Service, Bismarckplatz 1, 14193 Berlin, Germany, telephone: +49 30/89 03-2400, 2422, 2304, telefax: 89 03-2912. A directory of all publications by the UBA is available here free of charge. Information concerning the entire range of information available as well as short summaries from selected publications are also available on the Internet at www.umweltbundesamt.de, under "Issues".

Environmental requirements of the EU Structural Fund

The *EU Regulation on the European Regional Development Fund (Regulation No. 1783/1999)* has boosted the mechanisms for promoting sustainable development. The Federal **REGIONAL DEVELOPMENT PLANS** for the main subsidy areas in Germany (Target-1 areas) were completed in the summer of 1999 by the leading ministries for economics in the new Federal States.

Regional Development Plans: *Plans drafted by the Federal States for the regions to be subsidised through the EU structural funds.*

Target-1 area: *All areas where the gross domestic product per capita is more than 70 % below the EU average.*

In October 1999, Germany submitted the "Regional development plan for the new Federal States – Structural Fund period 2000–2006" to the EU Commission. This plan was rejected by the Commission in December 1999. This rejection was particularly due to the estimated effects of the structural fund intervention on the environment that was assessed as insufficient.

The complete environmental chapter had to be re-drafted. This task was based on the following key aspects:

- Analysis of the strengths and weaknesses in **TARGET-1 AREAS**

- Development aims and paths to be taken for action
- Coherence of the development strategy with regional, national and Community policy
- Sustainable development.

In close co-operation of the BMU (Federal Ministry for the Environment), UBA and the company nova in Düsseldorf, the new environmental chapter for the German Regional Development Plan was drafted within two months. The EU Commission has accepted the revised chapter and integrated this into the Common Subsidy Concept. This is how the UBA and BMU have managed to create a considerably more demanding level for assessing the environmental effects of structural fund intervention without significantly delaying the approval of subsidy funds. *(I 1.1)*

Sustainable Germany II

The UBA future study "Sustainable Germany – Ways Towards Long-term Environmental Development" from 1997 is being continued further. Early in 2002, "Sustainable Germany II" is due to be published. New topics and new viewpoints had to be taken up in order to continue this work. This study – similar to the first project – will focus on analysing problems and working out measures for selected central fields of action. *(I 1.1)*

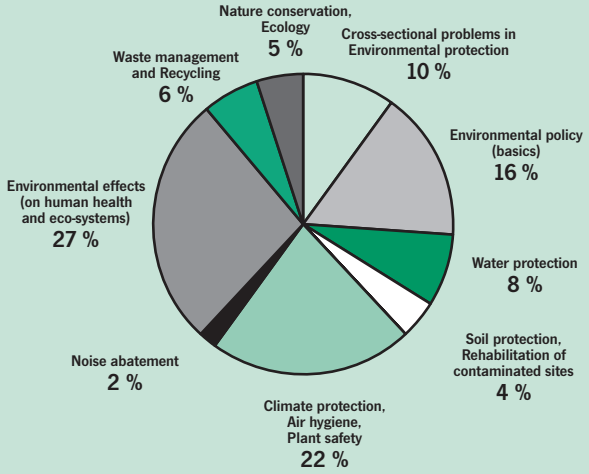
International visitor and guest programme

In 2000, around 300 representatives from other countries visited the UBA. More than half of the these visitors came from China and Japan. The guests, usually leading figures, such as ambassadors, ministers and ministry representatives, came to the UBA in order to exchange information with experts and to find new ideas for their own projects. Setting up and operating an environmental agency, ecological agriculture, environmentally compatible technologies and waste management were subjects of particular interest. *(I 1.2)*

Black Triangle

Based on the joint declaration by the ministers for the Environment in Germany, Poland and Czechoslovakia in Dobris (today's Czech Republic) on 22 June 1991, the EU Commission's **PHARE PROGRAMME** from

Figure 17: Key aspects of the 2000 research budget



1991 to 2000 subsidized a project titled "Black Triangle" for the rehabilitation of the central European brown-coal area. Within the scope of this project, a secretariat was set up in Ustí nad Labem (Czech Republic). A German representative from Saxony's Federal Ministry for the Environment and Agriculture was appointed to this secretariat. The work by this German expert has been co-financed by the UBA using funds from the **TRANSFORM PROGRAMME**. *(I 1.2)*

PHARE Programme: *EU aid programme for central and eastern Europe.*

Transform Programme: *Assistance programme by the Federal Government for central and eastern Europe.*

Advisory assistance programme for environmental protection in eastern Europe

Subsidy areas within the scope of the follow-up Transform Programme are the EU candidate countries of Bulgaria, Estonia, Lithuania, Latvia, Poland, Romania, Slovak Republic, Slovenia, Czech Republic and Hungary, as well as the New Independent States (NIS), first of all, primarily Russia and the Ukraine. Furthermore, the Regional Environmental Center (REC) in Szentendre (Hungary) as well as the Baltic Environmental Forum (BEF) in Riga (Latvia) are also being supported as trans-national co-operation pro-

jects. In 2000, the programme focused on lending support to advisory projects that were agreed to within the scope of bilateral environmental conventions. This included the transfer of environmental and technological know-how as well as the transfer, implementation and execution of legal regulations. In the year 2000, a total of 21 projects amounting to around EUR 1.18 million were subsidised. *(I 1.2)*

"Umbrella" eco-label for tourism services

Due to its considerable growth in recent decades, tourism has become particularly relevant for the environment. Environmental quality labels for tourism that aim at combating the growing burdens for the environment caused by tourism, have up to now failed to reach their environmental target, i.e. to promote the move towards environmentally friendly products and services. On the contrary: there is a huge flood of labels that has led to confusion among consumers.

A single "umbrella" eco-label is now to lead the way out of this dilemma. One label can do more than an environmentally quality label that merely promises adherence to objective product properties: it includes positive, emotional contents that go beyond the scope of environmental protection.

The label name *viabono* was selected. The logo is rounded off by the claim "Enjoying travel naturally" (Figure 18). Over 20 partners from tourism, environmental and consumer associations, as well as central municipal associations have formed a broad support platform for viabono. At the Internationale Tourismus-Börse (ITB) [International Tourism Exchange] in Berlin, the new label was presented to the public on 6 March 2001 and met with a positive response. *(I 1.2)*

Following completion of the design phase of label development, the label will be introduced to the market in the second half of 2001.

Figure 18: The new umbrella eco-label viabono

Further information on this subject is available from the Division I 1.2 of the UBA (address: page 94) or on the Internet at: www.viabono.de.

European travel by rail, bus and ferry

Anyone wishing to travel by train to a holiday destination within Europe needs a lot of information. There is often a choice of different routes, types of trains or times of departure. Each country has a wide range of special offers that can reduce the price of the train trip considerably. The destination selected can often only be reached through a combination of train and ferry or even bus. Only very few travel agency employees have all this information at hand or are willing to sell these foreign travel tickets that require a lot of advice and which are not very lucrative for travel agencies. Due to cost pressure, more and more small and medium-sized travel agencies are no longer selling rail tickets.

In order to close this gap in information and offers, an advice project for travel agencies and holidaymakers was initiated with Verkehrsclub Deutschland (VCD) [German Transport and Traffic Club]. The result of this project is a brochure which shows that when travelling to almost any European holiday destination there are attractive alternatives to travelling by air or car. This brochure contains all special offers available for Europe's rail systems: from the economy trips by Deutsche Bahn to the cheap ticket purchase on site. Five overview maps also show the best day and night connections when travelling abroad from Germany, as well as ship timetables and numerous other interesting addresses for information and for the Internet. *The "Zügig durch Europa" [Rapidly through Europe] brochure is available free of charge at all Deutsche Bahn AG travel agencies or by sending the amount of EUR 5.10 to: Verkehrsclub Deutschland (VCD), Subject: "Zügig durch Europa", Postfach 170 160, 53027 Bonn, Germany. (I 1.2)*

On the Net

Since 1997, the UBA has been offering specific information via the Internet. Meanwhile, this site records hundreds of thousands of contacts every year, with 4.6 million hits on the pages. In 2000, 40 % of orders for publications were received via the Internet. Due to the high degree of acceptance for this medium, this offer is continuously being re-

Scientific publications

In 2000, the UBA issued over 90 scientific publications (BERICHTE [REPORT] series: nine titles, TEXTE [TEXTS] series: 59 titles – five of which are also available on CD-ROM – as well as 23 titles outside the UBA series. Figure 19 (page 98) shows this development.

"Bestsellers" in 2000 included:

- Jahresbericht 1999 [1999 Annual Report] (on paper and CD-ROM)
- Praxishandbuch zur grenzüberschreitenden Abfallverbringung [Practical guide for trans-border waste shipment]
- Manual on Sport and the Environment (German and English)
- Traffic and Transport in Environmental Management – Instructions for Company Recording of Transport-related Environmental Influences (German and English)
- Energiespar-Contracting als Beitrag zu Klimaschutz und Kostensenkung – Ratgeber für öffentliche Liegenschaften [Energy-saving contracting as a contribution towards climate protection and cost reductions – a guide for onwers of public land] (on paper and CD-ROM)
- Leitfaden für die Innenraumlufthygiene in Schulgebäuden [Manual on Better Indoor Air Hygiene in School Buildings]
- EMAS in Germany (English edition of the "EG-Umweltaudit in Deutschland – Erfahrungsbericht 1995–1998" [EU Environmental audit in Germany – report on experience 1995–1998])
- Bürgerbeteiligung in Lokale Agenda 21-Initiativen [Public participation in Local Agenda 21 initiatives]

Information literature

In 2000, the UBA has once again issued a wide range of new information literature. The following brochures and leaflets were some of the most popular:

- Leaflet: "stromwen.de – Jetzt kräftig sparen!" [stromwen.de – Make huge savings, now!]
- Leaflet: "Von Mehrwegen und Irrwegen" [Talking of recycling and going astray]
- Leaflet: "klickital! – Meine Umwelt" [Click-it! My environment] nationwide photo competition
- A six-part poster series "Ietze und Eberhard"
- Paperback: "Environmental Protection in the Federal Republic Germany"

viewed, updated and supplemented by additional reports. *(I 1.3)*

Click-it! My environment

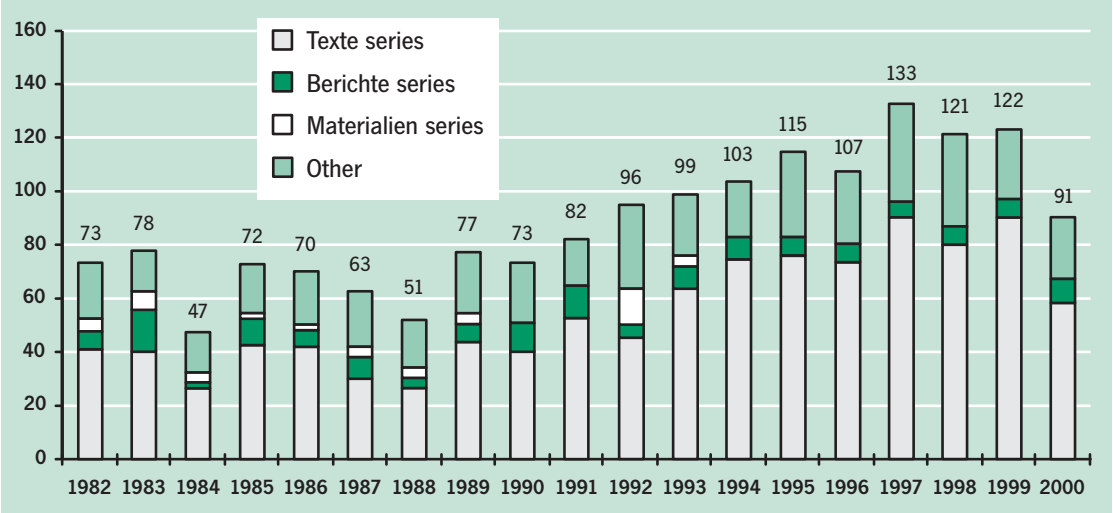
Success or failure in environmental protection depends heavily on how the public participates. In order to boost awareness for environmental protection measures whilst at the same time improving the transparency of such measures in Germany, the UBA held the nationwide photo competition "klickital! Meine Umwelt" [Click-it! My Environment] where participants were able to document in digitised form their individual perception of the positive changes that have taken place in Germany's environment. This created a virtual image of the success of environmental protection in Germany.

Over three thousand entries were received focusing on parts of Germany's natural environment that are protected or worthy of protection (plants, trees, landscapes, waters, animals, etc.), as well as environmental projects and measures that were implemented in Germany and were of a model nature. A selection was used as motifs for the UBA calendar 2000 titled "Meine Umwelt" [My Environment]. *All the photos are documented in the newest 4.0 version of the CD-ROM "Ökobase Umweltatlas" [Ecobase Environmental Atlas]. This costs EUR 15.50 and is available from Clemens Hölter, Am Kuckesberg 9, 42781 Haan, Germany; telephone: +49 2129/5 10 11, telefax: +49 2129/5 10 13* *(I 1.3)*

Manual in English

Strategies, developments and the success of measures in environmental protection in Germany are also meeting with considerable interest abroad, above all, in developing and new industrialized countries in Asia and South America. Up to now, there was no up-to-date, comprehendible overall presentation in the English language. This is why the UBA has published an illustrated paperback with 140 pages covering the most important facts and data on environmental protection in Germany. This paperback was intended to provide information to foreign institutes and people interested, for international events such as fairs and exhibitions, for foreign visitor groups and other English-speaking parties interested in this topic. *"Environmental Protection in the Federal Republic Germany" is available free of charge from the UBA's Central Answering Service (see box on page 94).* *(I 1.3)*

Figure 19: Development of publications from 1982 to 2000



Visitor service

Once again in 2000, a large number of groups from Germany visited the UBA to find out more about the work carried out by this Agency. Almost 2,000 school goers, students and others interested in politics visited the new multi-vision show "Das Umweltbundesamt – für Mensch und Umwelt" [The Federal Environmental Agency – For Humanity and Environment] and discussed topical environmental issues with scientific staff. *(I 1.3)*

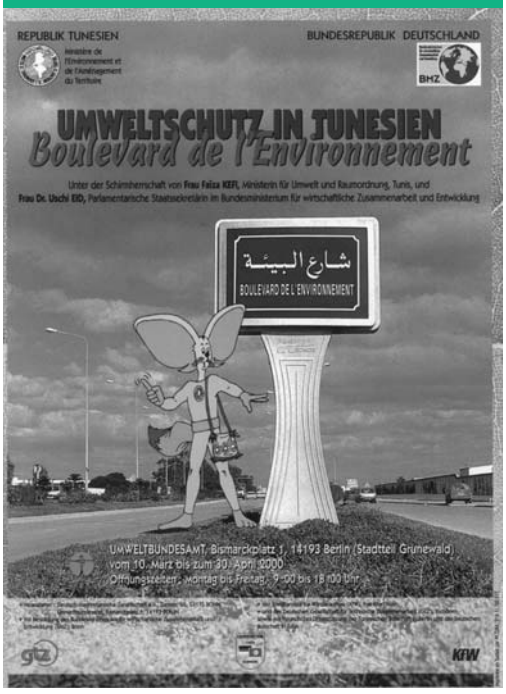
Exhibitions at the UBA

Three visiting exhibitions at the UBA in 2000 marked the continuation of the agency's long event series titled "Kunst und Umwelt" [Art and the Environment]. Artist Bärbel Rothhaar from Berlin presented a series of large-scale, sensuous paintings that deal with the central counterpoints of human life and nature: vitality and transience, stability and fragility, abiding and departing. The widely travelled artist Charlotte Herzog vom Berg in her exhibition "Ferne Welten – ganz nah" [Distant worlds – quite near] showed exotic recollections or dreams of landscapes in which symbols, signs and ornaments from different cultures are integrated.

For the ninety-year old Israeli painter Yehudith Bach, her exhibition at the UBA in October 2000 was a dream come true. She had the opportunity to present her life's work, in particular, her landscape paintings that are marked by light of the Mediterranean, in a city that was once her home and which she was forced to leave in 1933.

In March 2000, the Tunisian Ministry for the Environment in co-operation with the Germany Embassy in Tunis and the Gesellschaft für Technische Zusammenarbeit (GTZ) demonstrated the efforts by this north-African country in the interest of sustainable develop-

Figure 20: "Boulevard de l'Environnement" poster



ment in an exhibition title "Boulevard de l'Environnement" (figure 20).

Around 40,000 visitors were recorded in 2000 at this and other exhibitions as well as UBA's other visitor area. *(I 1.3)*

Ecological discourse

From April to July 2000, the experimental series of ecological discourse was held for the fifth time in the Literaturhaus Berlin and was organised by the UBA in co-operation with Freie Universität Berlin. Under the motto: "Energie und Freiheit" [Energy and Freedom], experts from science, business and culture discussed with the auditorium on ten evenings demand, resources, distribution and prospects in the energy sector. *(I 1.3)*

Central Answering Service (ZAD)

The number of queries from almost all sections of the population increased considerably once again in 2000. Whilst just under 74,000 turned to the UBA to ask for information and advice, this number has since grown steadily to reach over 130,000 in the year 2000. This increase in the number of queries is primarily due to electronic queries via the Internet. The UBA's Central Answering Service (ZAD) has received 44,000 queries from the Net alone.

(I 1.3)

Promoting associations and environmental advice services

With 28 environmental associations active nationwide, the UBA has promoted – on behalf of the Federal Ministry for the Environment (BMU) – 44 different projects with a finance volume of just under EUR 1.54 million. In the field of environmental advice services, subsidies for a total of 21 projects totalled around EUR 844,000. *(I 1.3)*

Involvement in fairs

Once again in 2000, the UBA took part in numerous trade fairs both in Germany and abroad. Here are just some of these fairs:

- Dynamic World Business Fair, 27 to 29 January 2000, Nagoya (Japan)
- Europäische Konferenz Zukunftsbeständiger Städte und Gemeinden [European Conference on Sustainable Cities and Towns] 9 to 12 February 2000, Hanover
- CeBIT, 24 February to 1 March 2000, Hanover
- ENVEX 2000, 22nd International Exhibition on Environmental Technologies 2000, 26 to 29 June 2000, Seoul (South Korea)
- ENTSORGA, Internationale Fachmesse für Recycling und Entsorgung [International exhibition on recylcing and disposal], 26 to 29 June 2000, Cologne
- ITEP China 2000, International Technology for Environmental Protection in China, 11 to 14 September 2000, Beijing (China)
- SHIGA Environmental Business Exhibition, 18 to 20 October 2000, Nagahama (Japan)
- Internationale Fachmesse Wasser [International Water Congress], 23 to 27 October 2000, Berlin

(I 1.3)

Green genetic engineering and ecological agriculture

On 18 December 2000, specialist talks were held at the UBA on the subject of "Green genetic engineering and ecological agriculture" where possible solutions for protecting ecological agriculture whilst assuming, at the same time, the use of genetically altered plants in conventional agriculture, were discussed with eco-agricultural representatives from research, industry and administration.

This round of talks showed that a legal framework for protecting eco-agriculture in the sense of non-genetically engineered areas and distancing rules between fields that are farmed using genetic engineering, conventional and ecological methods could be needed in the future. *The results of these talks on "Grüne Gentechnik und ökologische Landwirtschaft" [Green genetic engineering and ecological agriculture] (TEXTE series 23/01) are available from Werbung + Vertrieb (see box on page 94).* *(I 1.4)*

Regional processing and marketing

Regional, environmentally friendly produced quality products and their marketing are becoming more and more important for maintaining and nurturing the cultural landscape. Several initiatives have already been triggered on site. The UBA is promoting a co-operation project by Naturschutzbund Deutschland (NABU) [German Conservation Organization] and Deutscher

Verband für Landschaftspflege (DVL) [German Association for Landscape Conservation] that aims at improving the network of information between regional initiatives. Furthermore, a competition is currently being prepared in the project where the most environmentally friendly regional initiatives are to be awarded. Promoting products that are produced without damaging the environment, "From the Region – For the Region" is also an important contribution towards reducing the growing volume of traffic required to transport foodstuffs and hence the related environmental burdens. Information on the many activities underway in this field is issued within the scope of the "Regional Post" magazine project. *Further information on the subject is also available on the Internet at: www.reginet.de. The "Regional Post" magazine can be ordered from Deutscher Verband für Landschaftspflege e.V., Eyber Straße 2, 91522 Ansbach, telephone: +49 981/9504-247, telefax: +49 981/9504-246.* *(I 1.4)*

Best available techniques for intensive livestock farming

According to the *Integrated Pollution Prevention and Control Directive (IPPC Directive, 96/61/EEC)* of 24 September 1996, a pan-media concept is required in order to determine the Best Available Techniques (BATs) for intensive livestock farming.

In order to gain an overview of the techniques in use in Germany, a research project titled "Beschreibung der Besten verfügbaren Techniken in der Intensivtierhaltung" [Describing the best available techniques in intensive livestock farming] that was set up under the leadership of the Kuratorium für Technik und Bauwesen in der Landwirtschaft (KTBL) [Curatorium for Technology and Construction in Agriculture], initially surveyed existing animal farming methods for IPPC-relevant farms using a suitable questionnaire. The results of the survey document the state and extent of livestock farming systems. Based on these results, particularly advanced methods were identified. This was carried out on the basis of a standard data pattern according to the specifications of the IPPC Directive. Germany has submitted its report with BAT recommendations to the co-ordination office in Seville that is preparing the European recommendation for BATs in intensive livestock farming. *The study will be available in the second half of 2001 in the TEXTE series from Werbung + Vertrieb (see box on page 94).* *(I 1.4)*

Selecting and developing indicators for sustainability

Sustainability indicators are indicators that can be used to describe the status and development of trends in order to determine whether Germany is any closer to its goal of sustainable development (refer to chapter 3).

The test phase for sustainability indicators initiated by the UN Commission on Sustainable Development, UN-CSD, began in 1996. Within the scope of this test phase, the Wuppertal-Institut für Klima, Umwelt, Energie [Wuppertal Institute for Climate, Environment, Energy], in Wuppertal, carried out in 2000 on behalf of the UBA the research project "Methodische Weiterentwicklung von institutionellen Indikatoren für eine Nachhaltige Entwicklung" [Methodological further-development of institutional indicators for sustainable development]. Based on the concept of sustainable development, the authors suggest that "institutions" should be understood as the central elements of social action, such as Organizations, associations and the press, as well as their underlying mechanisms. This refers to the type and form for decision-making and orientation, such as role models and self-understanding.

The indicators provided by the CSD were examined and new indicators were developed. The results of the research project form a foundation both for the further research into indicators as well as for defining the term sustainability with greater precision.

Based on the experience and results that Germany has gained as a test country during the selection and development of sustainability indicators, and aided by the research project that commenced in September 2000, "Schlüsselindikatoren für Nachhaltige Entwicklung" [Key indicators for sustainable development], that was awarded to the Heidelberg-based ifeu-Institut, the suggestions for a practical indicator system for reporting on sustainability in Germany are being worked out. *The concluding report is available from the UBA's Division I 1.5 (address on page 94).* *(I 1.5)*

Gender and sustainability

A project titled "Geschlechterverhältnisse und Nachhaltigkeit" [Gender and Sustainability] has been initiated by the UBA's "Frauen und Umwelt" [Women and the Environment] working group. The project deals with the following, so far neglected, gender aspects of environmental and sustainability policy:

- Women and men are often not involved to the same extent nor in the same way in the cause behind environmental problems.
- Women and men are often affected in different ways by the impacts of environmental policies and measures.
- Experience, competence and aims of women must be applied increasingly in environmental policy decision-making and development processes if our society is to be able to meet current and future ecological challenges.

The aim of the project is to make the scientific knowledge in this field available, to recommend measures that consider this knowledge in the working context of the UBA and to implement this in an exemplary form.

The example of different working fields that are relevant for sustainability, such as mobility, consumption, product development, time and resource management is to be used in order to depict and document the status quo of research and discussion on the subject of "Gender and Sustainability", for example, in projects within the scope of the Environmental Research Plan (UFOPLAN) of the BMU (Federal Ministry for the Environment) and the UBA. Furthermore, work is to be carried out on the following issues:

- a paper to be presented at the 2002 Earth Summit (Rio + 10, refer to chapter 3),
- a women's pool and network,
- a guideline for evaluating gender-specific impacts of environmental policy measures,
- a guideline for taking gender-specfic aspects into consideration for environmental research projects.

(Project GN)

Division I 2:

Legal, economic and sociological issues related to the environment; environmental planning; energy

Access to genetic resources

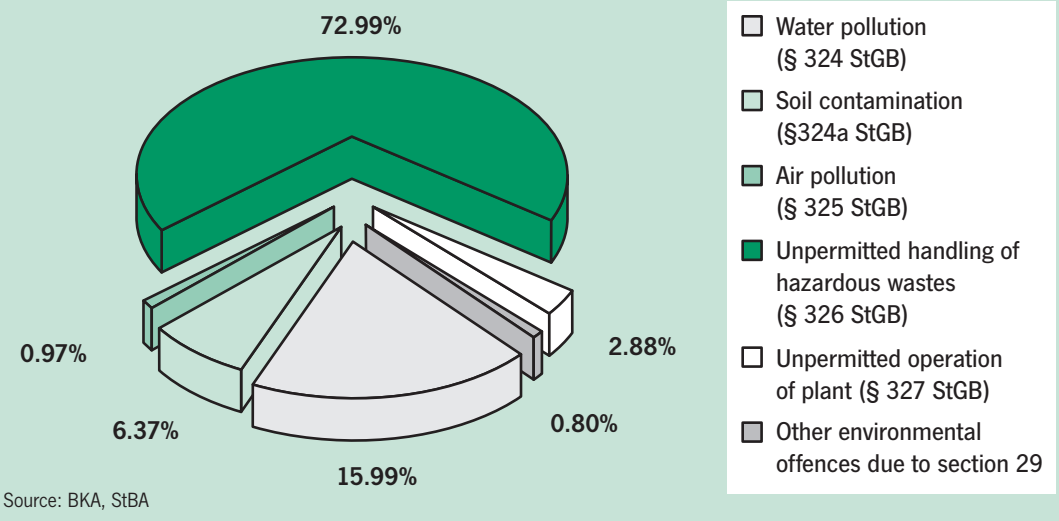
Genetic resources, for example, tropical plants, should be used in a manner that ensures the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources – as is stated in Article 1 of the *Convention on Biodiversity.* Defining this balancing of interests between states, companies and indigenous peoples in precise detail was the task of a research project which the Federal Environmental Agency (UBA) commissioned to the Max-Planck-Institut für ausländisches öffentliches Recht und Völkerrecht [Max-Planck-Institute for foreign public law and international law] in Heidelberg. The authors of the study, Prof. Dr. Rüdiger Wolfrum and Dr. Tobias Stoll, recommend that international, non-binding codes of conduct should be developed. This could be based on the example of the *International Code of Conduct for Plant Germplasm Collecting and Transfer* that was drafted by the Food and Agriculture Organization of the United Nations (FAO). This is an international code of conduct for collecting and transferring plant germplasm.

The study "Gestaltung der Bioprospektion unter dem Übereinkommen für biologische Vielfalt durch international unverbindliche Verhaltensstandards – Hintergründe, Möglichkeiten und Inhalte" [Shaping bioprospection under the Convention on Biodiversity using international, non-binding codes of conduct – background information, possibilities and contents] (BERICHTE 4/00) is available from Erich Schmidt Verlag, Berlin, as well as the convention report on the "European Workshop on Genetic Resources Issues and Related Aspects – Access and Benefit sharing, Intellectual Property Rights, Ex-Situ Collections – Proceedings and Materials" (BERICHTE 5/00). Both books are available through bookstores (ISBN 3-503-05934-2 and 3-503-05935-0). (I 2.1)

Approval of industrial facilities

On 13 November 2000, a meeting of experts was held at the UBA under the title "Erfahrungen mit umweltrechtlichen Genehmigungen anhand exemplarischer Standorte" [Experience with approval under environmental legislation based on exemplary locations] where the results of the research project, that was carried out under the same title, were presented and discussed with representatives from administration, business, environmental associations and science. According to the empirical survey carried out by Schitag, Ernst & Young in Ratingen, the potential for accelerating approval procedures have, following the efforts of recent years, been widely exhausted. *The survey "Erfahrungen mit umweltrechtlichen Genehmigungen anhand exemplarischer Standorte" [Experience with approval under environmental legislation based on exemplary locations] (BERICHTE 1/01) is available from Erich Schmidt Verlag, Berlin, and through bookstores. (I 2.1)*

Figure 21: Environmental offences in Germany in 1999



Source: BKA, StBA

Environmental offences

In 1999, 43,382 environmentally relevant offences were recorded in Germany (1998: 47,900). This marks the first decline in 10 years by around 7 % (figure 21).

These figures were taken from the evaluations by the Bundeskriminalamt (BKA) [German Federal Office of Investigation] and the Statistisches Bundesamt (StBA) [Federal Statistical Office]. In 1999, 36,663 crimes were registered pursuant to sections 324 to 330a of the *German Penal Code*, 11.4 % fewer than in the previous year. The majority of offences were committed in the field of environmentally hazardous waste disposal, accounting for 72.9 % (26,762 cases), followed by contamination of waters, accounting for 16 % (5,862 cases). The third most-frequent offence is – just like last year – soil contamination, accounting for 6.4 % (2,336 cases). Unauthorised operation of plants was recorded with 2.9 % (1,056 cases). In the case of air pollution, 355 cases (1 %) were identified. 0.8 % (292 cases) was divided between offences related to the unauthorised handling of radioactive substances and other hazardous goods (142 cases), causing of noise, vibration and non-ionised radiation (44 cases) as well as serious environmental hazards due to the release of toxic substances (59 cases) and the endangering of areas requiring protection (47 cases).

Apart from violations pursuant to section 29 of the German Criminal Code, 48 cases of violation of other environmentally relevant sections of the German Criminal Code were also registered, primarily in conjunction with radiation protection. Furthermore in 1999, 6,147 violations (1998: 5,589) of the law of supplementary environmental penalties – nature conservation, animal protection, wildlife and plant protection – were recorded, this was an increase rate of 10 %

The information rate of 58.9 % for the entire country is up 3.9 % against the previous year. Saxony-Anhalt with an information rate of 79.7 % was this year's leader, followed by Bavaria (79.3 %) and Baden-Württemberg (73.3 %). Berlin with 21.2 % had the lowest information rate. *(I 2.1)*

Using globalization in the interest of environmental protection

Globalization must be oriented more towards environmental aspects and sustainability. The multilateral trade agreements drafted within the scope of the World Trade Organization (WTO) have an important role to play in this context. At the 3rd WTO Ministerial Conference in Seattle (USA) in December 1999, however, the attempt to open a new round of trade liberalisation, which gives greater consideration to environmental aspects and sustainability, initially failed. A survey carried out on behalf of the UBA by the "Trade" working group of the "Forum Umwelt und Entwicklung" [Forum for the Environment and Trade], Bonn, outlines the core elements and unanswered

questions of a new trade policy that is oriented more strongly than before towards environmental and development-policy dimensions. *The survey titled "Die WTO-Ministerkonferenz in Seattle – Ergebnisse und Perspektiven für den Umweltschutz" [The WTO Ministerial Conference – results and prospects for environmental protection] (TEXTE 40/00) is available from Werbung + Vertrieb (see box on page 94).*

(I 2.2)

Ecological tax reform

In light of the enormous increases in energy prices, the ecological tax reform adopted by the Federal Government was severely criticized. The UBA drafted a paper for a public hearing on the *Entwurf eines Ökosteuer-Abschaffungsgesetzes [Draft for an eco-tax abolition law]* held on 15 November 2000 in Berlin. This paper addressed in detail this severe criticism and analysed the effects of the ecological tax reform on the basis of the scientific findings available. Conclusion: Ecological tax reform is basically a step a in the right direction although it could be given more attractive incentives. It helps the environment and, according to a study by the German Institut für Wirtschaftsforschung (DIW), creates on the whole up to 250,000 jobs. *This paper and other information concerning ecological tax reform can be found on the Internet at: www.umweltbundesamt.de.* *(I 2.2)*

Need to reform property tax

Property tax is in urgent need of reform, because it requires a disproportionate level of administration, it violates the principle of equal taxation and provides absolutely no incentive whatsoever to reduce land utilization. In order to overcome these deficits, a property development tax was created within the scope of a research project as a possible alternative to the present property tax system. This taxation concept that was developed on behalf of the UBA by the Finanzwissenschaftliches Forschungsinstitut (FiFo) at Cologne's university upholds the traditional aims of property tax whilst at the same time contributing towards a reduction in land use and the careful handling of properties. *The study titled "Ansätze für ökonomische Anreize zum sparsamen und schonenden Umgang mit Bodenflächen" [Approaches towards economic incentives for the prudent and careful use of properties] (TEXTE 21/00) is available from Werbung und Vertrieb (see box on page 94).*

(I 2.2)

Added value: ecological investment

Ecological investments are making it possible: with shares, funds and other forms of investment, money is being earned to secure retirement benefits whilst at the same time doing something for the good of the environment. However, for many private investors, the ecological investment market is still a "closed book". A brochure published by the BMU (Federal Ministry for the Environment) und the UBA (figure 22) provides an overview of the market and the opportunities for ecological investing. In this brochure, the Ecologic Gesellschaft für internationale und europäische Umweltforschung, Berlin, [Ecologic society for international and European environmental research] provides a host of practical tips and information on the various types of ecological investment. *"Mehr Wert: Ökologische Geldanlagen" [Added value: ecological investments] is available free of charge from the UBA's central answering service (see box on page 94). It is can also be downloaded from the Internet as a PDF file (www.bmu.de).* *(I 2.2)*

Sustainable development in regional planning

Addressing the growing importance of regions for sustainable spatial and settlement planning, the UBA has commissioned a research project "Weiterent-

Figure 22: The "Mehr Wert: Ökologische Geldanlagen" [Added value: ecological investments] brochure

wicklung und Präzisierung des Leitbildes der nachhaltigen Entwicklung in der Regionalplanung und in regionalen Entwicklungskonzepten" [Further development and a detailed definition of the model for sustainable development in regional planning and in regional development concepts] that was carried out by the Institut für Management in der Umweltplanung [Institute for management in environmental planning] at Technische Universität Berlin. The results show that, among other things, the aims and requirements of sustainable development have up to now only been included to a certain degree in regional planning. There is as yet no systematic implementation of these requirements. *The study (TEXTE 59/00) is available from Werbung + Vertrieb (see box on page 94). Furthermore, documentation of meeting is also available: "Nachhaltige Raum- und Regionalentwicklung – wo bleibt sie? Befunde, Perspektiven und Vorschläge" [Sustainable spatial and regional development – where is it? Findings, prospects and recommendations], published by Verlag für Wissenschaft und Forschung, available through bookstores (ISBN 3-89700-222-1).* *(I 2.3)*

Environmental aims of spatial and settlement development

Environmental aims – quality aims and action aims – are a basic component of overall spatial planning that attempts to achieve sustainable settlement planning by assigning functions and distributing utilization. Within the scope of the Environmental Research Plan (UFOPLAN), the UBA has commission a survey on the systematic implementation and composition of environmental aims on over-regional planning levels. This survey was carried out by the Landscape Ecology and Landscape Planning department of the Spatial Planning faculty at Dortmund's university together with the office of grünplan in Dortmund. The survey showed, among other things, how aims can be defined with both hierarchical and spatial differentiation beyond the various planning levels. For this purpose, the regional green trains in Germany's Ruhr district were selected as a good example. All in all, more than 80 planning documents were evaluated in the survey. *The research report "Umweltqualitätsziele und Umwelthandlungsziele der Raum- und Siedlungsentwicklung" (TEXTE 45/00) [Environmental quality aims and environmental action aims in spatial and settlement planning] is available from Werbung + Vertrieb (see box on page 94).* *(I 2.3)*

Municipal environmental reports

Environmental reporting by municipalities is a central element in order to create a solid foundation for municipal environmental protection. It is an important keystone for Local Agenda work (refer to chapter 3). The work tool that was introduced a number of years ago, has been completely revised on behalf of the UBA by the German Institute of Urban Affairs and used to design a comprehensive guideline. Apart from environmental media, this document lists the key areas of action for communities with view to stock-taking and analysis, aims, measures and areas of action. *The guideline titled "Kommunale Umweltberichte – Leitfaden mit Praxisbeispielen für die Erarbeitung kommunaler Umweltberichte" [Municipal environmental reports – practical examples for drafting municipal environmental reports] (with a CD-ROM) is available from the German Institute of Urban Affairs, Deutsches Institut für Urbanistik, Straße des 17. Juni 112, 10623 Berlin.* *(I 2.3)*

Preventive flood protection

The UBA and the Institute of Ecological and Regional Development, Dresden, held in co-operation with the central municipal associations a workshop on 13 and 14 December 2000 on the subject of "Vorbeugender Hochwasserschutz auf kommunaler Ebene" [Preventive flood protection on a municipal level]. Preventive flood protection measures are first and foremost a municipal task.

In this context, it became clear that it is necessary to provide continuous information on the possibilities for securing and expanding retention areas, for retaining rainfall water on the surface and for reducing the damage potential. The central municipal associations declared their willingness to actively support this process. *Documentation titled "Vorbeugender Hochwasserschutz auf kommunaler Ebene" [Preventive flood protection on municipal level] (TEXTE 14/01) is available from Werbung + Vertrieb (see box on page 94). It is also available on the Internet at: www.umweltdaten.de/rup/default.htm.* *(I 2.3)*

Public local passenger transport in Poland

In November 2000, a Transform project (refer to page 95) was finalized in Poland in order to boost public local passenger transport. This project has been headed since autumn 1995 by the European

Natural Heritage Foundation (Euronatur) and the Polish Ecological Club (PKE) in co-operation with public local passenger transport companies and transport experts and the model city of Wroclaw. The aim was to maintain the high priority of bus and rail transport in Poland even in light of a tight financial situation and in competition with private car transport, to develop infrastructures, vehicles and operating modes that are environmentally friendly, customer-friendly and economically effective, and hence to contribute towards a sustainable urban and regional transport system.

Within the scope of the project, numerous seminars were held and information material was published on the most important topics. Every year, a widely covered conference was held with top representatives from the German and Polish ministries for the environment and transport. The aim was to improve the image of public local passenger transport and to provide for each and every citizen convincing arguments in favour of public local passenger transport.

One important result was the drafts for national laws on the legal securing of public local passenger transport as an elementary provision and for promoting investment using public funds for municipalities and regions. Part of these laws has already been ratified by the Polish parliament, and other sections are currently being discussed in the respective committees.

The interest of international financial institutions in public local passenger transport was triggered and these institutions have now granted loans to Polish cities enabling them to modernize infrastructures. Investments have meanwhile become clearly visible on the streets in the model city of Wroclaw. The first-ever passenger advisory council in Poland was also established here. *(I 2.3)*

Environmental impact assessment: legal foundation

Once again in 2000, the UBA was involved in the implementation of the revised *EU Directive on Environmental Impact Assessment (97/11/EU)* and the *Integrated Pollution Prevention and Control Directive (IPPC Directive, 96/61/EU)* in German legislation. These and other EU directives are to be transferred to German law within the scope of an article law that will change numerous environmental regulations on a federal level. The Federal Government approved the draft for this law on 25 October 2000; the German Bundestag ratified the law on 5 April 2001. In the event that the "Bundesrat" approves this law, it should come into force by mid 2001.

The UBA was also involved in the proposed *EU Directive on the Environmental Assessment of Certain Plans and Programmes.* The aim of this directive is to ensure throughout Europe that environmental im-

Public local passenger transport in Wroclaw: A shining model for other cities in Poland. (Photo: courtesy of Euronatur)

pacts that can be expected from numerous plans and programmes are comprehensively and carefully forecast and evaluated as early as during the start-up procedure. *(I 2.4)*

Transboundary environmental impact assessment

One focal issue at the UBA was the work on transboundary environmental impact assessment. First of all, mention must be made to the Agency's work on the *UN-ECE Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention)*. This primarily involves developing tools and recommendations. Secondly, an international database is also to be set up for test procedures that have already been completed.

The UBA took part in the bilateral negotiations with neighbouring states. The aim of these negotiations was to work out agreements or recommendations for transboundary environmental impact assessment. This work is at times backed by support from research projects. For example, the planning group Ökologie und Umwelt [Ecology and the Environment] in Hanover is investigating the process of transboundary environmental impact assessment on the basis of three examples. Furthermore, the Institut für Stadtforschung und Strukturpolitik, [Institute for urban research and structure policy] in Berlin and INVESTprojekt in Brno (Czech Republic), have developed joint recommendations for testing procedures in the German/Czech border area. *"Handlungsempfehlungen zur Umsetzung des UN ECE-Übereinkommens über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen (Beispiel deutsch-tschechischer Grenzraum), Teil 1: Informationshandbuch (Entwurf)" [Practical recommendations for implementing the UN ECE Convention on Environmental Impact Assessment in a Transboundary Context (example of the German/Czech border area), Part 1: Information Manual (Draft)] (TEXTE 54/00) is available from Werbung + Vertrieb (see box on page 94).* *(I 2.4)*

Protection of the Antarctic region

Since 1994, the UBA has been responsible for approving activities in the Antarctic region and for the protection of plants and animals (refer to chapter 1). For the 1999/2000 season, the UBA received a total of 41 registrations and applications for activities on the sixth continent; 29 of these were related to research (including logistics) and four were related to tourism activities with some of these applications being group applications covering several trips by large passenger ships.

The majority of cases was approved by the Agency. Some of the projects, however, were categorised as having "at least slight or temporary environmental impacts, so that they had to undergo an environmental relevancy test. This aim of this procedure is to assess the environmental impact of an activity on the basis of detailed information submitted by the applicant. If this is seen to be "slight or temporary", the activity is then approved and, when necessary, subjected to restrictions and preconditions. In the event of more serious environmental impacts, however, an environmental impact assessment must then be carried out. This involves detailed forecasting and assessment of the environmental impacts in which other authorities, the public and other signatory countries of the *Protocol on Environmental Protection to the Antarctic Treaty* can participate. This environmental impact assessment procedure also includes the involvement of the international environmental protection committee as agreed under the Protocol.

In three of the applicant cases, the Agency assessed that "more than just slight or temporary environmental impacts" had to be expected. This was related to the effect of acoustic equipment with a high sound pressure – usually so-called air guns or the "Hydrosweep" multi-beam echosounder – on whales and other sea mammals. Since there was not enough time left to perform an environmental impact assessment before the activity was due to start, the Agency was not able to approve these activities.

Another case was the procedure concerning the international "EPICA" ice coring project for which such a comprehensive environmental impact assessment was carried out. It was already underway in July 1999. This is the world's first assessment of this kind after the Protocol on Environmental Protection to the Antarctic Treaty came into force. It was then seen to be an exemplary procedure for other similar cases, even in other countries. Based on the results of this assessment, in which a number of other countries contributed their statements, the project was approved in October 2000 with certain restrictions and preconditions.

In 2000, the Agency was also involved in the development of numerous legal regulations that are to supplement the *Regulatory Statute to the Protocol on Environmental Protection to the Antarctic Treaty*. Mention must be made in this context to the *Antarctic protected areas regulation*, which, based on international resolutions, lists 64 areas and 74 historical sites and monuments as specially protected. This regulation was ratified in July 2001. Another regulation, *Cost ordinance on the Environmental Protection Regulatory Statute* is due to be ratified in the near future. *(I 2.4)*

Climate protection through energy-saving contracting

Many municipalities and Federal States have expressed their commitment to climate protection. The implementation of energy-saving measures, however, is becoming increasingly difficult in light of ever-scarcer public funds. Energy-saving contracting is one solution to this dilemma. It means that the energy saving potential in public institutions is investigated by a third party, i.e. a contractor. This contractor carries out energy-saving measures under his own economic responsibility. The investment required here is financed by the savings in energy costs. Result: the climate is protected and operating costs are reduced without burdening public investment funds. On behalf of the BMU (Federal Ministry for the Environment) and the UBA, a working group comprising the Berlin office of Öko-Institut and Berliner Energieagentur have prepared a comprehensive practical advice manual designed to promote energy-saving contracting. At the expert meeting on 7 December 2000 in Berlin, this manual was presented and discussed. *The advice manual "Energiespar-Contracting als Beitrag zu Klimaschutz und Kostensenkung" [Energy-saving contracting as a contribution towards climate protection and cost reductions] is available free of charge from the UBA's central answering service (see box on page 94).* *(I 2.5)*

Renewable energy on the liberalized electricity market

On 1 April 2000, *the Act on Granting Priority to Renewable Energy Sources (Renewable Energy Sources Act)* came into effect. This marked the further development of the *Act on the Sale of the Electricity to the Grid* that had been in force since 1990, adapting it to conditions on the liberalized electricity market. This law includes important elements of the Act on the Sale of the Electricity to the Grid, particularly, an obligation on the part of network operators to purchase and remunerate electricity from renewable sources. New, on the other hand, is the nationwide balancing regulation which leads to equal distribution nationwide of the costs incurred under the Renewable Energy Sources Act. Fixed remuneration rates in variable amounts are another new element and, in conjunction with efficient operations management, enable the economically effective operation of plants. This will benefit in particular biomass electricity generation and solar energy. The Renewable Energy Sources Act now also includes electricity production from offshore wind power. In a research project together with a working group under the leadership of the Deutsches Zentrum für Luft und Raumfahrt (DLR), Stuttgart, [German Aerospace Centre], the UBA has examined and evaluated instruments for promoting the use of renewable energy. *The report titled "Klimaschutz durch Nutzung erneuerbarer Energien" (BERICHTE 2/00) [Climate protection through the use of renewable energy sources] is available from Erich Schmidt Verlag, Berlin, and through bookstores.* *(I 2.5)*

Wind and biogas on the upswing

Once again, 2000 was a very good year for wind energy use. Germany was able to expand its leading position in the world even further. 1,496 wind power installations with a total power of 1,668 megawatts (MW) were installed in this year alone. By the end of the year, this meant that 9,375 wind power installations were rotating with a total power of around 6,100 MW. In a normal wind year, around 2.5 % of Germany's power demand can be satisfied in this way.

The number of planning and approval applications for large wind farms near the North Sea and Baltic Sea is growing. In the case of offshore wind energy use, however, certain marine protection issues have yet to be clarified before considering large-scale utilization of wind energy at sea. The UBA has dedicated a major research project that started in 2000 to issues concerning offshore wind power utilization that comply with marine protection requirements (detailed information on this can be found on page 133). The improved economic framework conditions have also had a rather sudden impact on the erection of new biogas plants. After stagnation and modest growth in recent years, interest in biogas plants increased significantly

following the ratification of the Renewable Energy Sources Act. By the end of 2000, around 1,250 biogas plants were in operation in Germany. *A background paper one wind power use is available on the Internet at: www.umweltbundesamt.de.* *(I 2.5)*

Hand in hand: climate and imission protection

In preparation of an *EU Directive on National Emission Ceilings for Acidification and Ground-level Ozone (NEC Directive),* the UBA has examined the effects of climate protection measures and the emission of sulphur dioxide (SO_2) and nitrogen dioxide (NO_x). The regulations currently in force, which are orientated towards what is today state of the art, have already led to drastic reductions in SO_2 and NO_x emissions in the past. They will lead to further reductions by 2010, being the target year for the NEC directive. With this imission protection legislation, the UBA expects that in the period from 1990 to 2010 SO_2 emissions will fall from 5,320 kilotonnes (kt; 1 kt = 1,000 tonnes) to 565 kt and emissions of NO_x will decline from 2,710 kt to 1,165 kt. These reductions, however, still fail to provide sufficient protection against acidification of eco systems and the formation of ground-level ozone. Taking the climate protection measures already adopted and currently being discussed, the UBA has examined the impacts that a doubling of power generation from cogeneration plants by utilities and private operators as well as in industry would have in the period from 1997 to 2010. The UBA also looked into a doubling of electricity and heat generation from renewable energy sources.

The UBA is of the opinion that most new cogeneration plants will be smaller, decentralized units that primarily use naturally gas. These plants will then replace electricity from coal-fired power stations, heat from oil and gas central heating systems in households, industry, the trade and services sectors, as well as process heat from industrial boiler plants. The doubling of renewable energy sources will also replace electricity from coal-fired power stations and – in as far as these plants generate heat – heat from oil and gas heating systems. The effect of these measures are shown in table 7.

Based on the energy-related carbon dioxide (CO_2) emission statistics from 1997 (867 million tonnes), these three measures could reduce CO_2 emissions by the year 2010 by almost 9 %. This would thus be a huge step towards fulfilling Germany's obligation under the Kyoto Protocol (refer to chapter 7). *(I 2.5)*

Reduction in emissions in the production of reinforced concrete walls

The medium-sized company Hans Riffel GmbH & Co. KG produces reinforced concrete walls and ceilings at its factory in Dischingen, Germany. In the past, these were produced on oil-heated tilting trays in single-piece production mode with enormous energy losses. Production – including ancillary work such as formwork and reinforcing – was carried out entirely by hand. No satisfactory solution had been found to solve the problem of waste and waste water disposal. This is why the company was determined to modernise production in order to streamline production and to reduce its impacts on the environment. The concept foresaw a series of measures, including:

- converting the production process to more modern, semi-automated flow technology where cement is cured centrally in a heat-insulated, steam-heated dry chamber in order to reduce heat loss;
- replacing the heating oil system, which supplied the heat for the individual trays and for the hall heating system, with a natural-gas fired steam

Table 7: Effect of selected climate protection measures in 2010

Reductions in emissions	*CO_2 Mio t*	*SO_2 kt*	*NO_x (NO_2) kt*
Doubling of power generation from cogeneration plants (without industry)	*25.4*	*30.3*	*25.3*
Doubling of power generation from cogeneration plants (in industry)	*21.4*	*23.8*	*2.3*
Doubling of electricity and heat generation from renewable energy sources	*30.2*	*15.9*	*16.9*
Total	***77.0***	***70.0***	***44.5***

generator in order to supply the dry chamber with steam and using gas-fired infrared radiators to heat the indivdual workplace areas;
- using a residual concrete recyling sytem that returns the inivdiual components (sand, gravel, superfines) and waste water back into the production process.

This project, which is financed by funds from the "Investitionsprogramm zur Verminderung von Umweltbelastungen" [Investment programme for the reduction of environmental burdens] has led to a considerable reduction in environmental burdens. 1.3 million kilowatt hours (kWh) of primary energy are, for example, saved every year due to the low energy requirement of the new production structure. This figure takes changes in production into consideration and corresponds to around 130,000 litres of fuel oil. 356 tonnes of carbon dioxide emissions were avoided. Emissions of nitrogen dioxide fell by 95.4 %, from 433 kg to 21 kg. *The final report is available on loan from the UBA library under No.: 1514 (address: see page 94).* *(I 2.6)*

Division I 3:

Transport, Noise

Pollution and noise calculations on roads

In order to calculate air pollution in a specific urban road situation, the Federal Environmental Agency (UBA) commissioned the development of the CITAIR computer program. CITAIR (computer-supported Instrument for Forecasting the Effects of transport measures for reducing imission) permits:
- to take into consideration the average transport development, including the pertinent changed structure of the vehicle population up to the year 2020,
- to integrate current developments in fuel quality and emission limits,
- to calculate the effect of numerous local transport planning measures on traffic density and structure.

This program was enhanced in 2000 by a noise emission part (CITAIR+). An English version of CITAIR was also introduced at the end of 2000. *License terms for the PC program and the reports are available from Unit I 3.1 of the UBA (address: see page 94).* *(I 3.1)*

Environmentally orientated heavy load tax

In 2003, the Federal Government will replace the current toll sticker system for HGVs with a mileage-based heavy load tax for heavy commercial vehicles. With this tax, HGVs will contribute towards the costs caused by them for road maintenance. At the same time, this heavy load tax can help to reduce pollution by road freight traffic if this tax is sufficiently high and differentiates between emissions. If not just the mileage costs that can be attributed to a particular vehicle were taken into consideration, but if external costs, i.e. the environmental and accident costs that cannot be directly allocated to a vehicle, were also considered, this would mean that the tax for each HGV kilometre driven would average around 0.80 DEM. The consequence of the resultant increase in costs for road freight transport would be serious economic adaptation problems. This is why the UBA has suggested orientating the heavy load tax more towards the aim of avoiding a further increase in HGV traffic, shifting more goods to rail transport and to reduce HGV emissions.

The UBA is of the opinion that the heavy load tax should be levied on all roads – and not just motorways – based on different emission categories and that this tax should be gradually increased in foreseeable steps of up to 0.40 DEM per kilometre by the year 2010 (table 8).

In order to identify the role played by heavy load tax in reducing environmental burdens and in order to de-

Table 8: Proposal by the UBA for a heavy load tax

Vehicle category	*Heavy load tax 2003 (DEM/km)*	*Heavy load tax 2010 (DEM/km)*
HGV pursuant to EURO 0	*0.20*	*0.48*
HGV pursuant to EURO I	*0.18*	*0.45*
HGV pursuant to EURO II	*0.16*	*0.42*
HGV pursuant to EURO III	*0.14*	*0.40*
HGV pursuant to EURO IV	*0.12*	*0.37*
HGV pursuant to EURO V	*0.10*	*0.34*
Trailer	*0.05*	*0.10*
Mark-up for semitrailer vehicles	*0.05*	*0.10*

velop recommendations for an effective system, the UBA commissioned the Universität Karlsruhe to carry out a research project that was completed at the beginning of 2001. The results of this project show that the toll of 0.25 DEM per kilometre currently being discussed will not lead to sufficient environmental improvements. The authors also confirm that a HGV toll that is restricted to motorways will lead to a shift in HGV traffic to secondary roads. *The report has been published in the TEXTE series and is available from Werbung + Vertrieb (see box on page 94).* *(I 3.1)*

Noise and emissions on main roads

One major aim in municipal policy is to preserve and improve the quality of life in cities. The importance which our society today places on mobility, in particular on car mobility, however, means an enormous burden for many citizens through noise and emissions. The planning recommendations that were drafted by the planning office of Richter-Richard, Aachen, on behalf of the UBA, provides municipal policy and administration, planning offices and interested citizens with material that

- identifies possibilities for reducing noise and emissions on inner city roads,
- addresses important aspects of planning preparation and implementation,
- provides special planning information and recommendations for parameters for typical inner city roads.

Based on practical examples, the success achieved with noise reduction is highlighted and planning errors are shown. *The brochure titled "Planungsempfehlungen für eine umweltentlastende Verkehrsberuhigung" [Planning recommendations for environmentally friendly traffic abatement] (TEXTE 52/00) is available from Werbung + Vertrieb as a printed version or on CD-ROM with colour illustrations (see box on page 94).* *(I 3.1)*

Opportunities for bicycle and pedestrian traffic

In ten selected municipalities, the offices of Planersocietät, Dresden, and ISUP, Dortmund, have carried out research into the status of bicycle and pedestrian traffic support on a municipal level as well as the implementation and impact of the revised *German Road Traffic Regulations* from 14 August 1994. This study that is being carried out on behalf of the UBA shows the large extent of ignorance in communities when it comes to possibilities for promoting pedestrian traffic. As far as bicycle traffic is concerned, however, these possibilities are fairly well-known. The municipalities and communities were not able to quantify the effectiveness of the promotion measures with a view to shifting to non-motorised forms of traffic. Furthermore, there was also usually a lack of awareness for the favourable cost-to-benefit ratio. In those municipalities and communities that were surveyed, the revised *German Road Traffic Regulations* had only partially led to improvements for bicycle traffic. The opportunities offered by the revised regulations are primarily seen where, from the very outset, the intention had been to promote bicycle transport. *The study titled "Förderung des Rad- und Fußverkehrs" [Promoting bicycle and pedestrian traffic] is available on the Internet as a PDF file at: (www.umweltbundesamt.de).* *(I 3.1)*

Noise assessment methods for the Federal Transport Network Plan

The general revision of the 1992 Federal Transport Network Plan also involves the revision of assessment methods. In the field of the environmental aspects that were taken into consideration in the overall economic evaluation of the transport projects, considerable deficits were found that had also been repeatedly pointed out by the UBA. In a research project, which was completed in February 2000, the UBA submitted a practical method for integrating the "Noise exposure in open spaces" component into the cost-and-benefit analysis. This supplementary recommendation was included in the Traffic Report 2000. *The final report "Lärmbewertungsverfahren für den Bundesverkehrswegeplan – Verfahrensvorschlag für die Bewertung von Geräuschen im Freiraum" [Noise assessment methods for the Federal Transport Network Plan – Recommendation for a process for noise assessment in open spaces] is available from Unit I 3.1 at the UBA (address: see page 94).* *(I 3.1)*

Field monitoring

On behalf of the UBA and Allgemeiner Deutscher Automobil-Club (ADAC) [German Automobile Club], testing was once again carried out in 2000 on cars with a view to exhaust gas emissions under real driving conditions. For this purpose, cars with up to 80,000 kilometres clocked up were taken on loan from private vehicle owners and measurements were carried

out which corresponded to the type approval conditions for the respective vehicle types. This procedure, referred to as field monitoring, was introduced under the *EU Directive relating to measures to be taken against air pollution by emissions from motor vehicles* for threshold limit EURO III and IV cars in Europe. During the course of the project, a considerable violation of the D4 threshold value (by 48 up to 287 %) was detected in an Opel Omega model that was classed, according to the *Act amending the Vehicle Tax Act* of 1997, as D4 for vehicle tax due to low pollutant emissions. The manufacturer stated that the provisions of the *Act Amending the Vehicle Tax* Act did not specify that the D4 limit values had to be adhered to over a certain period of time and refused to re-work the vehicles affected. Other manufacturers (including Renault, Nissan, Daihatsu, Mitsubishi) have accepted their responsibility in terms of environmental protection and, up to now, have checked around 322,000 vehicles in their workshops in order to eliminate the defects related to emission reduction that were detected during field monitoring. The EU Directive must be effectively implemented in Germany in order to ensure that the legally rooted limit values are adhered to on a permanent basis. *(I 3.2)*

Emission reduction in air traffic

Due to rapid growth, civil aviation is contributing increasing towards global warming. On behalf of the UBA, TÜV Rheinland, in Cologne, together with the Deutsches Institut für Wirtschaftsforschung, Berlin, and the Wuppertal-Institut, Wuppertal, have drafted "non-technical measures" for reducing emissions caused by air traffic and have evaluated these measures in terms of their effectiveness. For example, high vs. moderate kerosene tax and emission duties, as well as a combination of measures comprising high emission duties and low kerosene tax were analysed and evaluated. Furthermore, legal measures, such as restricting short-haul flights, as well as "soft-policy" measures, such as advertising and information campaigns for greater public awareness, were included in the study. The study came to the general conclusion that incentives for the further reduction of the specific fuel consumption are more likely to lead to a reduction in emissions than capping demand. *The study titled "Maßnahmen zur verursacherbezogenen Schadstoffreduzierung des zivilen Luftverkehrs"[Measures for cause-related emission reduction in civil aviation] (TEXTE 17/01) is available from Werbung + Vertrieb (see box on page 94).* *(I 3.2)*

EU Directive on fuels

The 2000 stage of the *EU Fuel Directive (98/70/EU)* will lead to a considerable reduction in the benzene level in petrol. Significant improvements will be seen starting in 2005 for sulphur (maximum of 50 parts per million, ppm) in petrol and diesel fuels, and for aromatic compounds (maximum of 35 %) in petrol. Although this stage is to be completed by additional specifications by the end of 1999, this Commission had by the end of 2000 still not yet presented any recommendations for this.

According to manufacturers, the so-called "enabling fuels" are the pre-condition for the introduction of new nitrogen oxide (NO_x) emission reduction technology for diesel cars and commercial vehicles as well as for lean-mix internal combustion engines that are said to enable consumption savings and hence CO_2 reductions of up to 15 to 20 %. This is why in Germany, starting 1 November 2001, tax incentives are to be introduced for "low-sulphur" petrol and diesel fuel with less than 50 ppm and, starting 1 January 2003, for "sulphur-free" petrol and diesel fuel with less than 10 ppm, where a tax of 0.03 DEM/litre is to be imposed on other fuels with higher sulphur levels. *(I 3.2)*

No measures against MTBE

MTBE (methyl tertiary butyl ether, refer to the 1999 Annual Report) is used to improve knock resistance in fuels. It was a replacement for lead compounds. With the reduction of benzene and aromatic compound levels – particularly in high-octane fuel – MTBE is now also to compensate for lower octane numbers. Once again in 2000, the UBA received specific information on MTBE contamination in the groundwater. In all these cases, it was possible to link this contamination to damage in fuel tanks in former petrol stations. The publication of an MAK value (maximum workplace concentration) of 50 millilitre per cubic metre (ml/m^3) by the Senate commission of Deutsche Forschungsgemeinschaft (DFG) [Organization for academic research in Germany] and the classification of MTBE in class 3B of the carcinogenic substances (no genotoxic effect) indicate that the MTBE risk can be seen as slight. Since MTBE as an additive in petrol enables the reduction of aromatic compounds in the fuel which are primarily responsible for the benzene emissions from the exhaust, the UBA considers additional measures against MTBE to be unnecessary. *(I 3.2)*

Motorcycles with catalytic converters cause less pollution – and even save fuel. (Works photo: BMW)

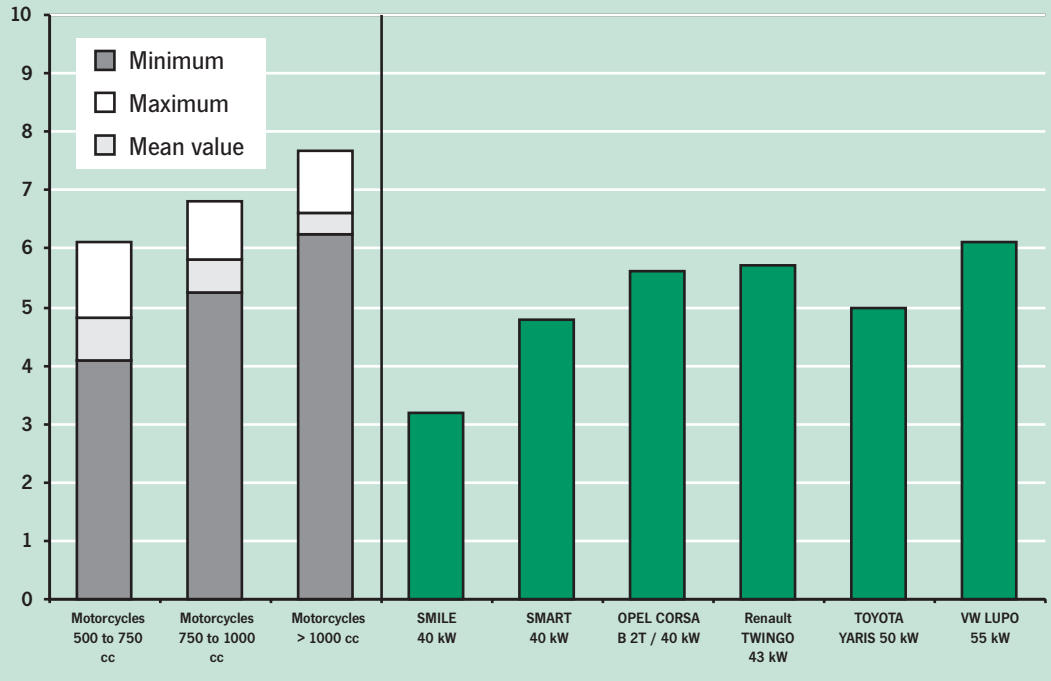
Exhaust emissions from motorcycles

Since 1990, the number of motorcycles has increased continuously. Compared to around 1.5 million vehicles in 1990, this number has doubled to 3 million by 1999. Since the strict exhaust limit values for cars and commercial vehicles will improve the quality of air in the future, the relative share of pollutant emissions from motorcycles in overall emissions continues to increase. This is why, within the scope of the Environmental Research Plan, the UBA has commissioned detailed surveys of pollutant emissions on 50 motorcycles – motorbikes and mopeds – and furthermore, 10 motorcycles that were retrofitted with catalytic converters were also examined since there are only a few motorcycle models with serial catalytic converters. The projects were completed to a large extent in 2000.

One motorcycle (four-stroke engine, 500 cc, without a catalytic converter) emitted during a weekend trip over a distance of 100 km as much hydrocarbons as around 40 cars complying with the EURO 4 standard. Comparing emissions with two-stroke-engine vehicles, i.e. mopeds, the picture is even worse, because in the case of two-stroke engines, due to their design, up to one third of the fuel is not combusted and is hence emitted with the exhaust fumes. Fuel consumption with these vehicles is also extremely high considering their restricted transport capacity and compared to compact cars (figure 23).

Retrofitting motorcycles with catalytic converters did in fact make it possible to reach a level comparable to the EURO II level for cars with catalytic converters. Fitting a Lambda probe additionally reduces fuel consumption. The measurements of evaporation emis-

Figure 23: Fuel consumption by motorcycles compared to compact cars



sions have shown that HC emissions were up to 18 times higher than those of state-of-the-art cars. This means there is a need for action in order to restrict future evaporation emissions also for motorcycles, as is already the case in the US. One positive example here is the manufacturer BMW, who meanwhile offers catalytic converters for its entire range of models.

(I 3.2)

Globally harmonized test cycle for commercial vehicle engines

An international effort is currently underway between Europe, Japan and the US to harmonize future emission legislation for commercial vehicle engines. A working group of the United Nations Economic Commission for Europe (UN-ECE) commenced work on this in 1998 with participation by numerous member states and industry. The technical side of this project was jointly handled by TÜV Automotive, Herzogenrath, on behalf of the UBA, and by the Dutch TNO Automotive, Delft, on behalf of the Dutch Ministry for the Environment.

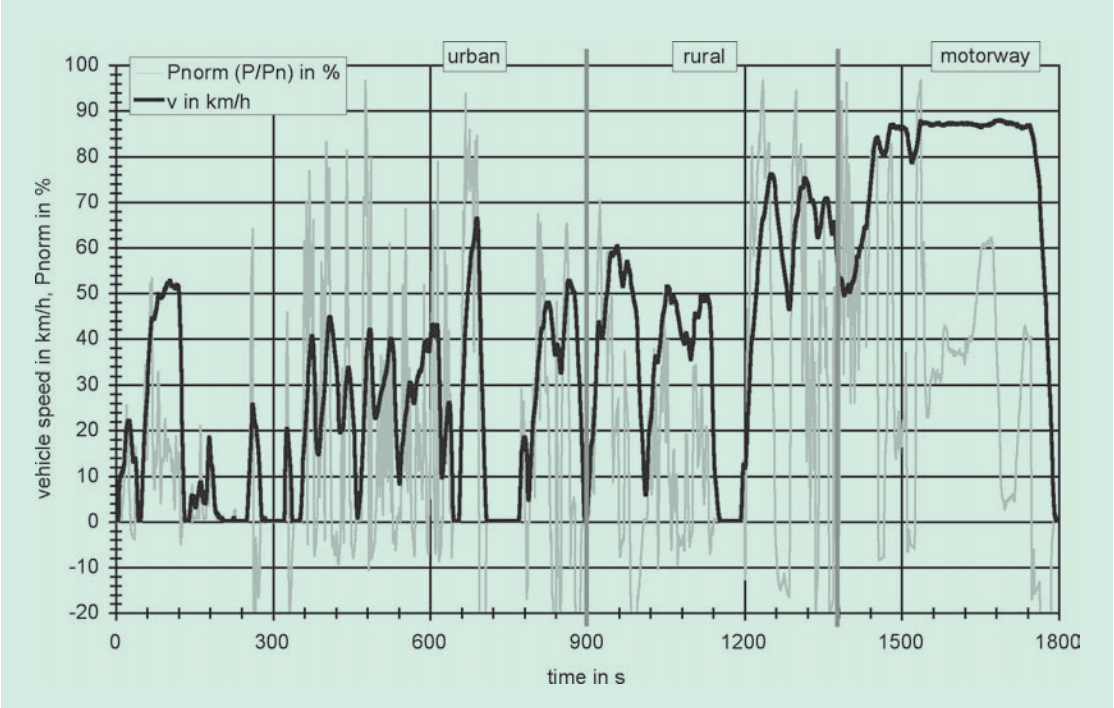
To begin with, data from Europe, Japan, the US and Australia concerning driving performance of 65 different commercial vehicles as well as statistics on stocks and use of commercial vehicles world-wide was evaluated. The results of this evaluation show that traffic conditions have a much greater influence on the performance and operating conditions of engines than regional differences in the technical design of vehicles, so that a globally representative test cycle can be reasonably defined. The cycle displayed in figure 24 was developed on the basis of this data and comprises an inner-district, an outer-district and a motorway section. This driving cycle will be simulated on the basis of the engine's data in an engine test cycle for testing emissions on the engine test bench. In the next phase of the project, this cycle is to be tested on the engine test bench using new engines (also including engines with soot filters) and compared to others that have been used up to now for type testing of internationally required cycles.

(I 3.2)

Thousand Environmental Taxis in Berlin

In October 2000, Minister for the Environment, Jürgen Trittin, representatives of the Berlin Senate, and gas utilities signed a declaration of intent at the AAA Automobile Exhibition in Berlin in order to promote natural gas vehicles in the German capital city. The

Figure 24: Test cycle for commercial vehicles



UBA was involved in preparing the technical foundation. The joint activities by the worlds of politics, gas and vehicle production will focus on the "TUT-Tausend-Umwelttaxis für Berlin" [TUT Thousand Environmental Taxis in Berlin] project. Together, all the participants will raise a total of EUR 11.5 million in order to promote natural gas taxis and natural gas driving school cars that meet with particularly advanced requirements. *The latest information is available on the Internet at www.tut-berlin.de.* *(I 3.2)*

Combating rail traffic noise

The Green Book titled "Future Noise Protection Policy" from November 1996 marked a new approach to noise protection by the European Union (EU). According to this policy, noise emissions from various sources, including traffic and industrial sources, are to be reduced further. This is why the EU Commission in December 1999 set up a working group on rail traffic noise that is headed by a UBA representative. This group is to identify the technical and economic aspects of a reduction in rail traffic noise at the source.

The most important recent work task involves supporting the EU Commission in the development of limit-value recommendations for noise emissions from rail vehicles. This is related to the technical harmonisation of transboundary rail traffic, so-called interoperability.

Noise limit values and measuring methods for high-speed trains were finalised by the end of 2000. According to the Commission's timetable, these will come into force in 2001 as a resolution by the Commission within the scope of "Technical Specifications for Interoperability" (TSI). The TSI for noise emissions from high-speed traffic will then mark the first-ever European noise regulation for rail vehicles. Noise limit values for conventional rail systems are then to come into force within three years. *(I 3.3)*

Noise regulations for motor vehicles

In a project currently underway within the scope of the Environmental Research Plan (UFOPLAN), the UBA has commissioned TÜV Rheinland, Cologne, to examine whether motor vehicles still comply with the specified limit values for noise, even after many years in use. Results up to now show that this kind of field testing is necessary: in the case of one commercial vehicle with the relevant number of licensed vehicles, the limit value for driving noise as well as for pressurised-air noise were exceeded considerably, the latter by up to 6 decibel (dB(A)). This corresponds to a quadrupling of the sound energy. The manufacturer of this vehicle has taken remedial action in the meantime. *(I 3.3)*

Noise measuring methods

Due to changed vehicle systems and higher traffic volumes, the operating and vehicle conditions in the type testing measuring methods are becoming more and more remote from real traffic conditions.

In order to ensure that future reductions in noise limit values can be reflected better in traffic than has been the case up to now, TÜV Automotive GmbH, Herzogenrath, has drafted a recommendation on behalf of the UBA for a future, improved type testing measuring method. This recommendation is meanwhile being discussed on an international level. The quick implementation of this recommendation would be an important step towards further reductions in motor vehicle noise. *(I 3.3)*

Noise reduction with trams and commuter trains

Trams and commuter trains have in recent years experienced a revival and are a characteristic feature of many a city district. These forms of transport do not emit any air pollution and have a high transport capacity. This means that they are an environmentally friendly alternative to individual motorised transport. On the other hand, noise from rail vehicles is causing increasing problems. Interaction between vehicle and track often results in enormous noise development.

This is why the UBA in 1997 commissioned Ingenieurbüro Uderstädt, Essen, to examine the noise abatement potential for trams by optimising the tracks and to derive design recommendations. This research project was completed in May 2000.

The examinations in the laboratory showed that a very soft intermediate layer in the superstructure reduces the noise imission into the ground, but increases audible sound radiation, i.e. noise. Within the scope of this project, different rail seats were examined and recommendations for improvements were presented. The onus is now on manufacturers to im-

prove rail seats in future with a view to their noise radiation. *The research report titled "Lärmminderungspotenziale an Straßenbahnen" [Noise reduction potential for trams] can be taken out on loan under number FKZ 29754810 from the UBA's library (address: page 94).* *(I 3.3)*

Revision of the Act on Aircraft Noise

The Federal Government plans to revise the *Act on Aircraft Noise* from 30 March 1971 before this term is over (refer also to page 127). In preparation for this, the UBA has submitted detail recommendations and has carried out comprehensive trial calculations for civil and military airfields. The results of this work are included in a detail paper prepared by the BMU (Federal Ministry for the Environment) on the revision of the act. It describes the aims targeted by this revision. This includes, among other things, the following improvements:

- Separate evaluation of aircraft noise levels for day and night
- Defining new lower limit values for protection zones
- Defining stricter imission limit values for airfields to be expanded
- Extending the scope of validity to other types of airfields
- Greater public participation

Further details can be found in the Internet at www.bmu.de. *(I 3.3)*

Acoustic track grinding

Deutsche Bahn AG (DB) has introduced the "specially monitored track", the so-called BüG track, for concrete sleeper tracks as an active noise protection measure. When calculating noise emissions with this type of track, the company can assume that the noise level in the immediate vicinity is 3 decibels (dB(A)) lower than in the case of a "normal track". The company undertakes to monitor "BüG tracks" every six months and – in the event that an intervention threshold is reached – to use a special grinding method, i.e. acoustic track grinding, in order to achieve a particularly low noise level. The UBA has taken measurements. First results are as follows:

- For "Intercity" and "Interregio" trains on tracks ground by an oscillating process, the 3 dB(A) reduction was confirmed, with emissions being 2 dB(A) higher on tracks ground by a rotary process. Further measuring is required in order to confirm these results.
- The different elasticity of the track structure – in particular that of the intermediate layer between the rail foot and the concrete sleeper – appears to influence noise emissions; soft intermediate layers can lead to an increase by several dB(A) in noise emission by slow running trains (freight trains and, to a certain extent, commuter trains). *(I 3.4)*

Noise reduction in rubbish collection vehicles

Rubbish collection trucks with side and overhead tipping mechanisms are being used increasingly in Germany. Measurements carried out on these vehicles show a high noise level during operation and hence a considerable burden for residents in residential streets. Within the scope of a research project, the UBA together with the superstructure manufacturer FAUN Umwelttechnik, Osterholz, used two model types to carry out, among other things, the following noise-reduction measures on the overall vehicle, i.e. on the support vehicle and on the superstructure:

- Acoustic optimisation of the engine and gearbox encapsulation: reduction of the engine working speed;
- Low-noise design for lifting cylinders and bin discharge
- Reinforcement in the throw-in and pressing shaft as well as the pressing mechanism.

These and certain other measures led to a reduction in the working noise of the vehicle by 7 to 8 dB(A) to an acoustic power level of below 97 dB(A). The two low-noise models that were built onto modern chassis fully comply with the standard performance requirements of the market. According to the manufacturer, the additional cost for low-noise vehicles is less than 8 %. *The final report titled "Lärmminderung bei Kommunalgeräten und Maschinen zur Festsetzung von Kriterien für lärmarme Technik" [Noise reduction in municipal equipment and machines for determining criteria for low-noise technology] is available from Unit I 3.4 at the UBA (address: page 94).* *(I 3.4)*

Low-noise leaf blower

Due to tight budgets in municipalities and communities, mobile leaf blowers are being used increasingly

Even a leaf blower can be less noisy – and still perform just as well. (Works photo: Kersten GmbH)

in order to maintain parks and landscapes and in order to reduce personnel costs. The economic advantages of this type of equipment are offset by the extremely loud noise generated by conventional blowers. This leads to a considerable amount of complaints about noise.

This is why the UBA has promoted the development of a low-noise blower with four-stroke engine for professional use by the company Kersten, in Rees. The Rheinisch-Westfälische TÜV (RWTÜV) was consulted with regard to acoustic matters. The changes in the sound absorbers in the suction and blow-out area as well as the improvements in the blades and the fan flow system led to a reduction in working noise by 13 dB(A) compared to conventional blowers to a sound level of under 96 dB(A). The engine used is designed for the future and already meets with Level II of the emission requirements of the US Environmental Protection Agency, US EPA, that are considered to be the strictest world-wide.

This low-noise blower meets with the standard commercial requirements – particularly with a view to blowing performance – and is only slightly more expensive than conventional equipment. The device has already been successfully sold.

One basic problem still remains, however: the use of blowers and suction devices damages and eliminates organic material and soil organisms. Despite the successful reduction in emissions from blowers, the UBA recommends that these devices should not be used. *The final report titled "Lärmminderung bei Maschinen und Geräten zur Festlegung von Kriterien für lärmarme Outdoorgeräte – Fahrbare Laubblasgeräte" [Noise reduction with machines and equipment for defining criteria for low-noise outdoor equipment – mobile leaf blowers] is available from Unit I 3.4 at the UBA (address: see page 94). (I 3.4)*

Cost of sound protection in residential buildings

In order to ensure that people can find peace in their homes, the planning phase must always observe architectural acoustic criteria and the actual construction work must be carefully supervised. It is then often possible to outperform the minimum requirements for sound protection without any additional costs. Today's construction technology and optimised floor plans make it possible to even save construction costs and gain additional floor space with improved sound protection. A study on behalf of the UBA at the Faculty for Construction at Universität Dortmund showed that differences in costs between different sound protection levels generally tend to be minor, compared to the price ranges that are otherwise customary in the building sector. The survey also showed, however, that installing higher sound protection levels with traditional solid structures can be uneconomical. One way to achieve cost-effective sound protection is to use light gypsum board walls within the living space rather than solid-structure walls. *The manual titled "Kostengünstiger Schallschutz im Mehrfamilienwohnungsbau nach DIN 4109 und VDI 4100" [Cost-effective sound protection in apartment buildings according to DIN 4109 and VDI 4100] for architects and planners is available from Unit I 3.4 at the UBA (address: page 94). (I 3.4)*

Machines and equipment for outdoor use

On 3 July 2000, the *EU Directive on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors (2000/14/EU)* came into force. The UBA played a major role in the preparation work. The directive contains requirements for marking 63 machines and devices (construction machines, hobby and garden equipment, municipal equipment) with the noise emission value and limit values warranted by the manufacturer for 22 of these types of machines. Before products can be brought onto the market, they must first undergo the defined conformity assessment procedure, with the manufacturer being obliged to include a declaration of conformity for each product. The directive must be transposed to and implemented in German law within one year. *(I 3.4)*

European Commission on environmental noise

At the end of July 2000, the EU Commission presented a proposal for an *EU Directive on the Assessment and Management of Environmental Noise* that was discussed in the European Council and European Parliament. The UBA was involved to a great extent in this work. On 18 December 2000, the common viewpoint was accepted. Compared to the Commission's proposal, considerable improvements – resulting not least from a German initiative – were achieved in the directive that, among other things, take the German experience gained with noise reduction planning under Section 47a of *Germany's Federal Imission Protection Act*. Some of the provisions of the draft directive are as follows:

- Large-scale, time-based noise mapping must be carried out for large agglomerations with populations of more than 100,000, streets with more than 3 million vehicles a year, rail routes with more than 30,000 trains a year and civilian airports with more than 50,000 flight movements a year.
- Action plans (noise reduction plans) must be introduced in areas where the criteria defined by the member states have been exceeded.
- The public must be informed of such activities.

(I 3.4)

Department II: Environment and Health: Water, Soil and Air Hygiene, Ecology

Division II 1:

Ecology

Eco-system approach of the biodiversity convention

At the 5th Conference of the Parties to the *Convention on Biological Diversity (Biodiversity Convention)* in May 2000 in Nairobi (Kenya), the resolutions adopted included the principles of the so-called eco-system approach. This refers to an approach that includes all interests when implementing measures for the protection and sustainable use of biological diversity (refer also to page 16). These principles are to be examined and enhanced through case studies and practical experience. Since the Federal Environmental Agency (UBA) has already gathered extensive experience with integrated approaches, the "Ökosystemforschung Wattenmeer" project [Eco-system research – mud flats] (Annual Report 1998, page 66) was used as an exemplary case in order to retrospectively evaluate the eco-system approach. *The case study can be downloaded at www.umwelt-daten.de/down-d/oekosystemansatz.pdf. Further information is also available on the Internet at www.umweltbundesamt.de, under "Biological Diversity", as well as at www.biodiv-chm.de.* *(II 1.1)*

Comprehensive reports and background information are available on many of the topics. Literature from the Federal Environmental Agency (UBA) can be purchased from Werbung und Vertrieb, Ahornstraße 1–2, 10787 Berlin, telephone +49 30/2 11 60 61, telefax +49 30 2 18 13 79. Material is also available free of charge from the UBA's Central Answering Service, Bismarckplatz 1, 14193 Berlin, telephone +49 30/89 03-2400, 2422, -2304, telefax +49 30 89 03-2912. A directory is also available here free of charge that lists all publications by the UBA. Information concerning the entire range of information available, as well as summaries of selected publications, are also available on the Internet at: www.umweltbundesamt.de, under "Issues".

Eco-systematic environmental monitoring I

Eco-systematic monitoring of the environment covers not just structures, but above all the functions and processes in eco-systems, and records their changes over a long-term period. It thus integrates and supplements existing sector-based environmental monitoring programmes and can act as an early warning system by monitoring trends.

Since 1997, the UBA and the Federal State of Bavaria have been promoting a pilot project on eco-systematic environmental monitoring in the Rhön biosphere reserve. The research project, in which the Federal States of Thuringia and Hesse are also involved, is soon to be completed. An evaluation concept is one of the core tasks of this project. For example, data on animals and plants are being evaluated whilst also taking the substances in the eco-system into consideration. With the WASMOD Water and Substance Simulation Model that was developed at Christian-Albrechts University in Kiel, condition scenarios are calculated and the effects of changes in use are determined. The area of the Rhön biosphere reserve is divided up into different areas – according to types of location.

After completion of the project in June 2001, a core data record as well as suggestions will be available in order to optimize sector or media monitoring programmes as well as to harmonise the methodology of data recording. *(II 1.1)*

Eco-systematic environmental monitoring II

Even while it was underway, the results of the pilot project referred to above already generated impetus for the eco-systematic management of environmental monitoring even in other regions. This includes the Schorfheide-Chorin biosphere reserve and the "Spreewald" region. An environmental monitoring concept was drafted for the Federal State of Schleswig-Holstein based on the model of the Rhön project. In the Berchtesgaden biosphere reserve, the calculation model adopted in the Rhön is also used.

Further information on this subject can be found on the Internet at (www.umweltbundesamt.de, under "Eco-systematic Environmental Monitoring").

(II 1.1)

International work group on environmental quality aims

At the 5th Alpine Convention in October 1998 in Bled (Slovenia), the ministers for the environment of the neighbouring Alpine states passed a resolution to establish an international work group to be headed by Germany. The task for this group was to submit a survey of the current status of development and implementation of mountain-specific environmental quality aims. The idea behind this measure was to promote the implementation of the *Alpine Convention* and the pertinent implementation protocols (refer also to chapter 1). The work group submitted its report in October 2000 at the 6th Alpine Convention in Lucerne (Switzerland). *This report is available on the Internet at www.umweltbundesamt.de, under "Mountain-specific environmental quality aims". (II 1.1)*

Effects on eco-systems and materials

Since 1989, the programme by the UN Economic Commission for Europe (UN-ECE), that is headed by Germany, for mapping **CRITICAL LOADS AND LEVELS** and violation of these loads and levels, has been underway with the participation of 24 European Countries. *Further information is available on the Internet at: www.umweltbundesamt.de/mapping.*

This programme persistently undergoes further development. For example, new methodological modules were integrated for calculating critical loads for acids and eutrophicating nitrogen.

The violations of the Critical Loads & Levels have also been revised by Öko-Data, Strausberg, using the latest imission values and air pollutant accumulations (depositions). Mapping of the pollutant concentrations in air (ozone, sulphur dioxide and nitrogen oxides) as well as the deposition of oxidised sulphur and nitrogen compounds, reduced nitrogen compounds and base cations was carried out throughout Germany on the basis of a data foundation that had been improved in terms of quality and quantity, with greater spatial resolution.

The final reports "Kritische Luftschadstoff-Konzentration und Eintragsraten sowie ihre Überschreitung für Wald und Agrarökosysteme sowie naturnahe waldfreie Ökosysteme" [Critical air pollutant concentration and imission rates as well as their violation for forest and agricultural eco-systems as well as relatively natural, non-forest eco systems] and "Deposition of acidifying components and base cations in Germany in the period 1987-1995" can be taken out on loan under numbers FKZ 297 85 079 and FKZ 297 84 081 from the UBA's library (address: see page 118).

(II 1.2)

***Critical Levels:** Concentration-related threshold values for the direct, acute effects of air pollutants, for example, the effect of ozone on plants.*

***Critical Loads:** Load-related threshold values for the indirect, long-term effects of air pollutants, for example, the effect of acidifying and eutrophicating air pollutants.*

Effect of air pollutants

Dynamic models play an important role in the long-term assessment of the effects of pollutants emitted into the air, particularly, in view of buffer capacity and the effects on soil. They make it possible to forecast risk developments on the basis of the reduction strategies adopted under the *UN-ECE Multi-component Protocol*. The need to harmonise in view of the models to be selected here and the input and model parameters that must be taken into consideration was defined at the international meeting of experts, "Dynamic Modelling" that was held from 3 to 5 October 2000 in Ystad (Sweden). Details of this can be found on the Internet at: www.unece.org/env/lrtap/multi_h1.htm.

With the value ranges defined for critical contents in soils and concentrations of metals, i.e. lead, cadmium and mercury, in the soil, that are addressed in the *Heavy Metals Protocol* of the *UN-ECE Convention on Long-range Transboundary Air Pollution* (www.unece.org/env/lrtap/hmh1.htm), an important step forward in the development of methods for calculating Critical Loads for heavy metals was achieved from 11 to 13 October 2000 in Bratislava (Slovak Republic).

Further information concerning the aforementioned protocols and the international co-operation programmes is available at: www.unece.org/env/wge.
(II 1.2)

Non-native organisms

Non-native, imported plants, animals, and microorganisms can – depending on the region and the accompanying circumstances – greatly contribute towards a decline in local biological diversity. In a research project at Universität Rostock, the Institut für Biodiversitätsforschung [Institute for Research into Biodiversity] presented on behalf of the UBA an inventory and evaluation of new invasive animal species (animal species imported by man since the year 1500) in Germany. Within the scope of active involvement in the *Convention on Biological Diversity (Biodiversity Convention),* six case studies – three on non-native invasive plants and three on non-native invasive animal species – were submitted. The case studies concisely sum up the experience with these non-native species on national and regional level. The examples show that the introduction and establishment of non-native organisms can change the biological diversity and also cause economic damage. The evaluation of these issues is the aim of another research product currently underway. "*Fallstudien zu gebietsfremden Arten in Deutschland" [Case studies on non-native species in Germany] (TEXTE 13/01) is available from Werbung + Vertrieb (address: see page 118).* *(II 1.3)*

Hormonal effect of chemicals: the bisphenol A example

From 18 to 20 November 2000, the Institut für Klinische Pharmakologie und Toxikologie [Clinic for Pharmacology and Toxicology] at Freie Universität Berlin and the UBA co-operated in a workshop on "Bisphenol A – Hohe Dosen – Niedrige Dosen" [Bisphenol A – High Doses – Low Doses]. The issue dealt with here was to what extent extremely low does of chemicals with a hormonal effect that are far below the currently accepted absorption levels can have a negative effect on organisms. This question is a key issue, both for the further development of test strategies and for the further development of evaluation strategies, as well as the question as to just how urgent precautionary measures are.

The incentive for this workshop was originally triggered by several publications in which the effects on the reproduction of animals were described that were exposed to low concentrations of this substance either prior to birth or in the early stages of development. These findings are particularly important for Germany since over 200,000 tonnes of bisphenol A are produced here every year and traces of this substance are being found in a growing number of environmental samples, foodstuffs and consumer goods. The discussions were marked by the following recent events:

- At the end of October 2000, a workshop on low doses was held by the US Environmental Protection Agency (US EPA). The result was that low-dose results were generally recognized – this did not correlate with opinion in industry.
- Also at the end of October 2000, the European Parliament passed a resolution in which the Commission was requested to immediately adopt – without performing any further testing – precautionary measures against identified environmental hormones. This demand is generally supported by a series of member states, including Germany.
- Bisphenol A is the primary product for the econimically significant and important market share of polycarbonates and synthetic resins. These main fields of application can be controlled and account for only a small part of cases of detectable exposure. What is difficult is a series of environmentally open applications, for example, heat-sensitive and carbon paper where relatively high burdens are inevitable.

Low-dose effects were generally accepted as being relevant for evaluations; in other words, they can no longer be ignored as "experimental mistakes". The UBA was able to promote discussions in this area. *Further information can be found on the Internet at: www.bisphenol-a.de.* *(II 1.3)*

Chemicals with a hormonal effect and the development of sperm quality

Several studies maintain that sperm quality in western industrial countries had fallen by 2 to 3 % per year from the 1940s up to today. According to these observations, the medium sperm count is nearing a range that is categorized by the World Health Organization (WHO) as being critical for fertility – at 20 million sperms per millilitre of ejaculate (mio./ml). Pollution with environmental chemicals is being discussed as the case behind this development, particularly with a view to those chemicals that affect the hormone system.

On 24 November 2000, the UBA held talks with experts on "Hormonell wirkende Chemikalien und Entwicklung der Spermienqualität beim Menschen" [Chemicals with a hormonal effect and the development of sperm quality in humans]. The studies presented by the authors were discussed with experts from the Federal Ministry for the Environment (BMU), the Advisory Committee for Environmentally Relevant Existing Substances (BUA-GDCh), the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV), the Federal Institute for Drugs and Medical Products (BfArM), the Robert Koch-Institut (RKI), from universities (Berlin, Hamburg, Halle/Wittenberg, Kiel, Magdeburg) as well as with co-ordinators from EU projects currently underway on sperm quality from Finland and Denmark.

Examinations in Magdeburg show that there is a correlation between the year born and sperm count and that the sperm count fell annually by 2.1 % in the period from 1974 to 1994. The sperm count among men in Berlin fell by 34 % between 1985 and 1996, among men in Leipzig by 24 %. A similar examination in Hamburg showed that between 1956 and 1980, the sperm count there fell from 64 to 20 mio./ml and has remained almost constant since 1980.

The results match the suggested trend of a reduction in sperm count by over 2 % per year in Europe.

The co-ordinators of the EU projects currently underway are of the opinion that the reduced sperm quality is one symptom among many which, on the whole, can be described as a development disturbance syndrome in male reproduction organs. The participants agreed that in Germany just like in other EU countries, studies should be carried out on the normal male publication. *(II 1.3, II 2.2)*

Environmental Survey

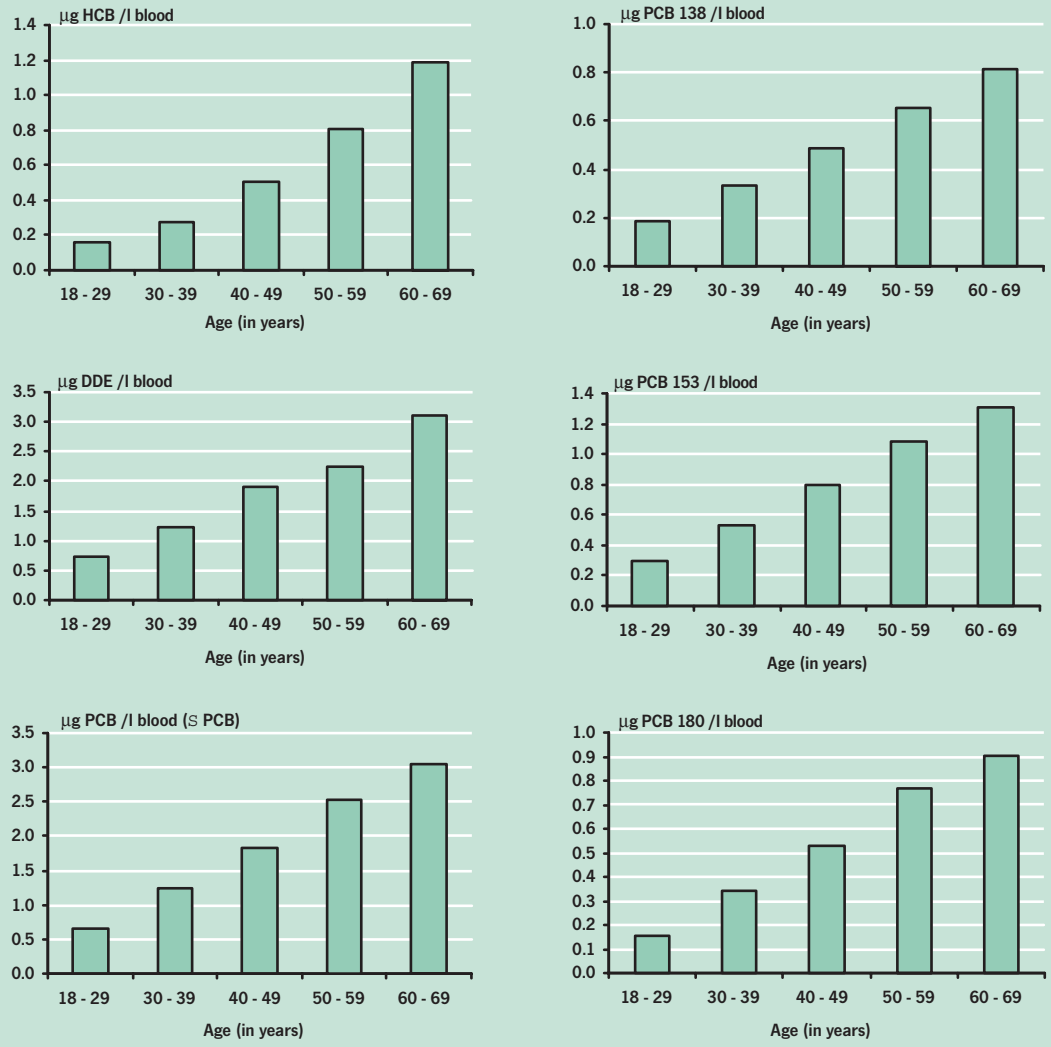
The objective of the Environmental Survey (www.umweltbundesamt.de/survey/index.htm) is to gather, update and make available representative data for environmental-related health monitoring and environmental reporting on a national level. This survey was carried out for the third time in 1998. A cross-section sample of 4,800 adults took part in the survey in which comprehensive data material is evaluated, for example, on pollutants in the blood and in urine, in household dust and in drinking water.

Among one group of around 2,800 people aged between 18 and 69, organochlorine compound levels in the blood were examined for the first time in 1998. These compounds were and are used in plant protection agents in agriculture and to combat malaria, and as material protection. The survey showed that levels of dichlor-diphenyl-trichlorethane (DDT), hexachlorobenzene (HCB) and polychlorinated biphenyls (PCB) increase with advanced age. This is due to the persistent intake of these substances and their long half-life in the human body (figure 25). The medium DDT level in the blood in the east German population is considerably higher than in the west German population. Whilst DDT in the east Germany was still widely used in 1989, it had been unconditionally prohibited since 1972 in the west Germany.

The opposite result was shown for PCBs. These are primarily used as cooling agents with a low conductivity level in the electrical engineering industry. These substances are persistent (permanent) and accumulate in the food chain. The considerably higher production volumes, the ban on production that did not come into force until 1989 in the west Germany and the discontinuation of PCB processing in the east Germany as early as 1985 explain the high medium PCB levels in the blood in the west German population.

Exposure to polycyclic aromatic hydrocarbons (PAHs) was examined in a sub-group of 573 adults from the 1998 Environmental Survey and also in 150 randomly selected adults who were non-smokers as well as in 668 children from the 1990/92 Environmental Survey. Figure 26 shows the result for concentrations of 1-hydroxypyrene (1-OHP) in urine which is regarded as an indicator for PAH. As is generally known, the 1-OHP level in urine is dominated by smoking, only the data from non-smokers was compared.

Figure 25: Organochlorine compounds in the blood among adults aged between 18 and 69 in Germany as a function of age



In 1990/92, considerably higher 1-OHP levels in urine were found in the population in the new Federal States. This is true for both adults and for children. The 1-OHP level in urine in adults fell in the period from 1990/92 to 1998, this is particularly true for the new Federal States. The Environmental Survey for Children and Youths is making it possible to reach conclusions concerning a time-related trend for PAH levels in urine in children. *(II 1.4)*

Health and Environmental Survey for Children and Youths

The preliminary work for a Health and Environmental Survey for Children and Youths was completed in 2000. The pilot phase then started in March 2001. Robert Koch-Institut (RKI) is responsible for managing the health survey project whilst the UBA is in charge of the environmental survey project. The aim is to gain the same kind of information on children and youths that has in the surveys up to date been primarily gathered for adults. This includes the gathering and updating of representative data on pollutant burdens for children and youths in Germany. Furthermore, comparative and reference values must also be adopted for healt-relevant substances from the environment, load paths must be identified and quantified, and time-related and regional development of these loads must be described.

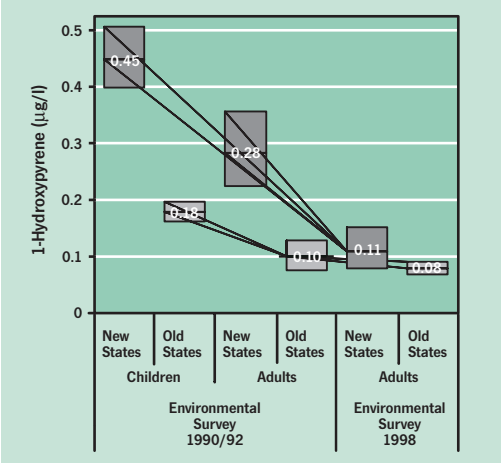
(II 1.4)

The Federal Government's Environmental Specimen Bank

In 2001, the Federal Government's Environmental Specimen Bank will have reached full-scale operations. In 13 selected regions in Germany, environmental specimens are being gathered, biometrically characterised and following in-depth analysis for environmental pollutants, stored over a long period under conditions that prevent chemical decomposition. *The results of this monitoring project that partially covers time series of up to 15 years are available on the Internet at: www.umweltbundesamt.de/umweltprobenbank.*

Examining the specimens archived in the Environmental Specimen Bank can offer insight into both current concentrations of hazardous substances as well as the long-term trend in the situation with hazardous substances in Germany.

Figure 26: 1-Hydroxypyrene in urine in non-smoking adults and children in the old and new Federal States in the years 1990/92 and 1998



The Hamburg-based ERGO Forschungsgesellschaft has analysed the levels of polybromated diphenyl ethers (PBDE), chlorohydrocarbons as well as dioxins and furans in human blood and human milk samples from different years. Whilst a strong reduction in dioxin and furan levels as well as for chlorohydrocarbons, such as DDT and PCB, was found, contamination levels with PBEs had increased significantly between 1985 and 1999.

The final report on the project is available on loan under number 297 63 155 from the UBA' s library. It is also due to be published soon in the TEXTE series and will be available from Werbung + Vertrieb (see box on page 118). *(II 1.4)*

Division II 2:

Environmental hygiene

Environmental medicine

In autumn 1999, the commission on "Methods and Quality Assurance in Environmental Medicine" was set up with the UBA's involvement at the Robert Koch-Institut (RKI). The commission is supported by the Central Registration and Evaluation Unit for Methods of Environmental Medicine [Zentrale Erfassungs- und Bewertungsstelle für umweltmedizinische Methoden (ZEBUM)] of the RKI. The main objective of the commission is to register methods and processes used in environmental medicine and to assess these under aspects of quality assurance. *(II 2.1)*

News from Umweltmedizinischer Informationsdienst

The Umweltmedizinischer Informationsdienst (UMID) [Environmental Medicine Information Service] was edited and published by the Institut für Wasser-, Boden- und Lufthygiene (WaBoLu) [Institute for Water, Soil and Air Hygiene] in the UBA from 1992 until 1999. In 2000, an editorial team was formed with members from the higher-level Federal authorities which are also involved in the implementation of the "Environment and Health" (Umwelt und Gesundheit; APUG) action programme. Thanks to the participation of the Robert-Koch Institut (RKI), the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV), as well as the Federal Office for Radiation Protection (BfS), it is now possible to cover an even wider range of inter-disciplinary relationships within the "environment and health" action programme. Furthermore, it is now also possible to present projects of the "environment and health" action programme to the public and to cover the progress of work. This is meant as a contribution towards improving information management in environmental medicine and co-operation between higher-level Federal authorities and those responsible for environmental medicine at Federal State and municipality levels. The UMID's publications include sum-

maries of new research results, experience reports on environmentally induced risk factors and health disorders, comments, recommendations, leaflets, polls, casuistries, questions and answers "from the practical world for the practical world". UMID's executive editorial staff belongs to department II 2.1 of the UBA. Six to eight numbers are published each year. *Free UMID subscriptions are available from the Central Answering Service of the UBA (see box on page 118). The UMID is also available on the Internet at www.umweltbundesamt.de under "Facts and Figures").* *(II 2.1)*

WHO Collaborating Centre for Air Quality Management and Air Pollution Control

Once again in 2000, one of the focal activities of the WHO Collaborating Centre for Air Quality Management and Air Pollution Control at the UBA was to ensure international quality assurance and quality control of air quality measurements. Within the scope of the "International intercomparison programmes for air hygiene measurements in the WHO region Europe", the tenth intercomparison programme was carried out in May 2000, this time for nitrogen oxides and sulphur dioxide, in co-operation with the Langen-based intercomparison programme facility which is the UBA's pilot station. The programme involved eleven experts from Bulgaria, Estonia, Yugoslavia, Croatia and Hungary. Despite different calibration standards, technical measuring equipment, measuring methods and experience backgrounds, the results were at times very similar.

The WHO centre used questionnaires and conducted interviews in order to analyse quality assurance programmes in 13 national air quality measuring networks, chiefly in central and east European states, and in order to compare these programmes to the WHO's requirements concerning the indicators of data quality, data availability and data comparability. There is generally speaking an urgent need to improve and harmonise quality assurance programmes at an international level, especially with a view to the importance of air measuring data for the evaluation of the impact of air pollutants on health in the WHO' Europe region. *The study titled "Status Report on Quality Assurance and Quality Control in Air Monitoring Networks" is available as report No. 14 of the "Air Hygiene Report" series of the WHO Centre for Air Quality Management. Free copies are available from the Central Answering Service of the UBA (see box on page 118). Further information on the work and publications of the WHO Centre is available on the Internet at (www.umweltbundesamt.de, under: "Events").* *(II 2.1/WHO Luft)*

Biocide emissions from latex paints

In order to prevent the growth of microorganisms in water-based latex paint, biocides are added to these paints. The substances most commonly used by paint manufacturers to this effect are formaldehyde depot substances, as well as 2-methyl-4-isothiazoline-3-on (MIT) and 5-chloro-2-methyl-4-isothiazoline- 3-on (CIT).

Laboratory and field tests were carried out in order to find out whether and to what extent such biocides can be released from wet paint into room air. Area-specific emission rates were determined for 24 wall paints in laboratory tests. In a test room painted with a paint containing CIT/MIT and having an initial concentration of 85 microgrammes of CIT per cubic metre ($\mu g/m^3$), a CIT concentration of 0.3 $\mu g/m^3$ was found even after eleven months (figure 27).

Methyl isothiazolinones have a strong irritating effect on skin and mucous membranes and are among the most important contact allergens. An increasing number of recent reports indicate that acute skin eczema can even by caused by exposure to the air in a room just painted with paint containing CIT/MIT. Therefore, considerable efforts must be made in order to find ways in the medium term for protecting water-based latex paint against microbial infestation, so that room users and occupants are not significantly exposed to biocides. *(II 2.2/II 2.3)*

Indoor air hygiene in schools

The UBA's commission on indoor hygiene has published a guideline for indoor air hygiene in school buildings in order to inform school goers, teachers and those responsible for the construction, operation and maintenance of school buildings. This brochure covers issues of air hygiene and related hygiene topics in school buildings, providing information concerning hygienically correct conduct in schools, as well as suitable procedures for handling complaints. Strong demand indicates that this guideline has closed a considerable gapage. Two editions were quickly snapped up and the third edition is currently being printed. Free copies of the *"Leitfaden für die In-*

nenraumlufthygiene in Schulgebäuden" [Guideline for indoor air hygiene in school buildings] are available from the UBA's Central Answering Service (see box on page 118). It is also available on the Internet. (www.umweltbundesamt.de). *(II 2.3, II 2.1)*

Healthy building

In May 2000, the UBA's WaBoLu indoor days were held for the seventh time, this time under the motto "Healthy Building". The terms "ecological building" and "healthy building" are often used as synonyms. However, objectives related to energy savings, resource saving and re-usability of construction materials which stand in the foreground of "ecological" building approaches do not necessarily address health aspects to a sufficient extent. Several papers discussed the pros and cons of buildings designed on the basis of health/ecology aspects on the one hand and conventional criteria on the other. Special attention will be paid in future to the description and evaluation of room air hygiene in buildings based on low-energy building standards. *(II 2.3)*

Nitrogen dioxide exposure among children

On behalf of the Karlsruhe Research Center, the UBA developed a simulation model from 1998 to 2000 in order to estimate children's exposure to nitrogen oxide (NO_2). This substance is important because epidemiological studies have indicated that higher NO_2 concentrations lead to an increased occurrence of diseases of the respiratory tract and an impaired lung function in children. Exposure rates were estimated in the model as a function of the individual's living situation – i.e. of the indoor air – and the exposure in the individual's living environment, including traffic-related exposure, i.e. outside air, for example (figure 28, page 126).

The studies show that the degree of exposure of children is determined to a very large extent by the NO_2 concentration in the outside air. The level of NO_2 concentration in flats is chiefly determined by the geographical location within the city and only secondly by the traffic in the immediate vicinity. Further results suggest that, on an annual average, the outside air is the most important influence factor for indoor NO_2 exposure even in the presence of indoor sources of NO_2, such as a gas cooker. *(II 2.3)*

Condition of bathing waters in Germany

The water quality of bathing areas in natural waters, such as lakes and rivers, was once again slightly better in 2000 compared to the previous year (table 9, page 126).

Figure 27: CIT air concentration in the test room after application of paint F9. One sees the influences of an artificial increase in humidity after around five months, application of another paint coating (F21, biocide-free) and a higher natural humidity and temperature in summer

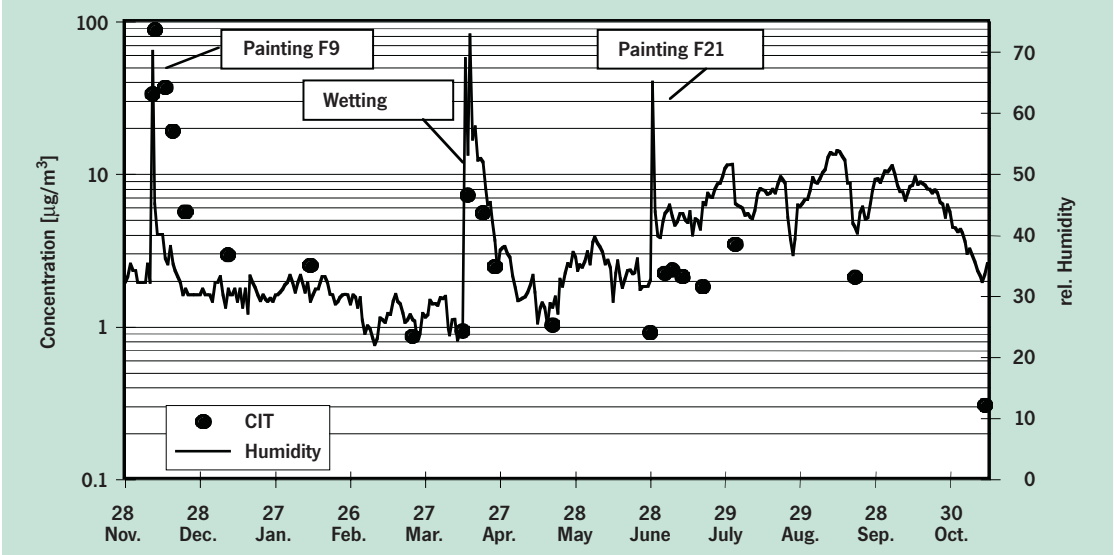


Table 9: Samples taken at bathing areas

	1998	1999	2000
Number of bathing points which were not sufficiently analysed	42	13	2
Number of criticized bathing points	173	123	108
Number of bathing points where bathing had to be prohibited	15	16	10

The number of criticized bathing points fell from 123 (6 %) in 1999 to 108 (5.3 %) in 2000. The number of cases in which bathing was prohibited declined too. This suggests that improved sewage treatment, reduced discharge of manure and slurry into drainage basins in the vicinity of bathing areas, as well as reduced rain water discharge rates are slowly beginning to pay off.

However, the complaint rate still seems to be high in view of the act that bathing waters are specifically selected for their superior microbiological quality. One must expect, and random analyses suggest this, that the microbiological quality of surface waters which are not classified as bathing waters is much worse. Bathing in such lakes involves an increased risk of disease, such as intestinal, kidney or liver disorders.

The monitoring intensity is very encouraging: The number of bathing areas which were not sufficiently analysed fell from 42 in 1998 to 2 in 2000.

(II 2.4)

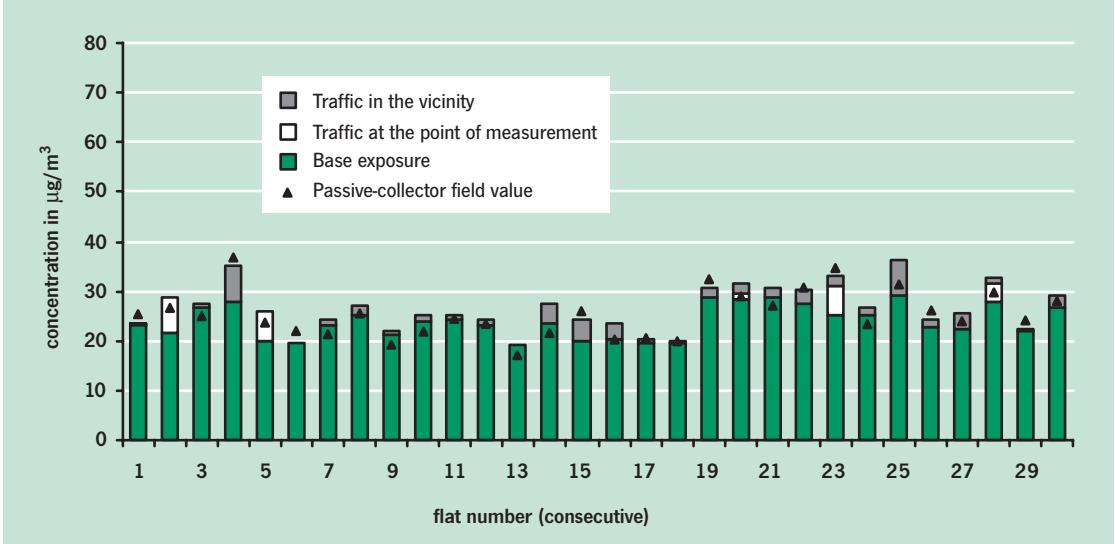
Ways for noise abatement

Each year in April, the so-called "Noise Awareness Day – A Day for Silence – Against Noise" is held. In the year 2000, just like the previous year, the UBA in co-operation with the German "Siftung Warentest" consumer organization set up a hotline where interested citizens were offered advice and information concerning ways to reduce noise.

People who feel annoyed by road traffic noise can order a noise report against payment of a fee. This report determines the noise level exposure to citizens caused by road traffic, and answers the question as to whether citizens have a right to demand noise protection and, if so, which options are available.

Almost 900 citizens have made use of this offer so far. Only 3 % of those who did so are exposed to noise levels which are not significant. As many as 64 % are exposed to noise levels that exceed 65 decibel (dB(A)) during the daytime. This is the level at which an elevated risk of cardiovascular conditions must be expected. *The expert report order*

Figure 28: Break-down of the modelled total NO_2 concentration in the outside air into base exposure and additional, traffic-induced exposure directly at the point of measurement, as well as in its vicinity, for all measuring places (flats) in Dresden and comparison to passive-collector field value.



form (form M 9805) can be requested by calling Stiftung Warentest at 0180-2 32 13 13 (Germany only). *(II 2.5)*

Noise effects of air traffic

Corresponding to the evaluation system in the traffic sector *(Traffic Noise Ordinance, Maglev Train Noise Ordinance)*, the UBA developed an analogous method for assessing air traffic noise in preparation of the work on amending the *Act on Protection against Traffic Noise*. This law is in line with the *Federal Immission Control Act (BImSchG)*. A more restrictive approach towards the definition of the scope of this new act reflects the fact that air traffic noise has a greater disturbance and annoyance effect than comparable road traffic noise (refer also to page 114). The current situation can be summarized as follows from the point of view of noise effect research:

- The threshold of substantial disturbance caused by air traffic is reached at 55 dezibel (dB(A)) during the day and 45 dB(A) at night.
- Air traffic noise levels of 60 dB(A) during the day and 50 dB(A) at night means that hazards for human health can be expected from the point of view of preventive medicine.
- Air traffic noise levels of 65 dB(A) during the day and 55 dB(A) at night means that hazards for human health expressed as cardiovascular conditions can be expected.

The complete report on "Fluglärmwirkungen" [Effects of Air Traffic Noise] is available on the Internet at (www.umweltbundesamt.de. It can also be obtained from department II 2.5 of the UBA (address on page 118). *(II 2.5)*

Noise annoyance as a problem

2000 was the first year in which the annoyance caused by noise to the population Germany was measured on the basis of the latest, internationally agreed standards. The advantage of this approach is improved comparability in the future of studies at an international level. A disadvantage is, however, that it is at present not possible to directly correlate the results of this survey with the results of the surveys conducted in 1998 and 1996 because these surveys were based on different questions. One result of the survey is summarized below (table 10):

Road traffic is still the most important source of noise nuisance. The large extent and the degree of nuisance caused by passenger cars and heavy-load vehicles show that substantially larger and more far-reaching efforts are necessary for the protection of citizens.

The high share of those annoyed by noise caused by their neighbours is a problem in that legislation in this field does not exist, nor is it expected to be introduced in the foreseeable future. *(II 2.5)*

Effect of noise barriers

When passenger trains pass by at high speed, the share of aerodynamic sound sources above the wheel-and-rail system increases with increasing speed. This can mean that the noise-abating effect of noise barriers is overestimated.

In order to address this issue in rules and standards, and in order to develop the basis for a revision of the calculation rules, the UBA has commissioned measurements to be taken at existing high-speed sections. The results suggest that the values measured and the values calculated on the basis of the applicable rules do match. In the case of passenger trains passing by at a high speed, however, considerable deviations of up to 5 decibel (dB(A)) were found. The rules for calculating the effect of noise barriers must be revised.

The reports "Abschirmwirkung von Schallschutzwänden bei Hochgeschwindigkeitszügen" [Shielding effect of noise barriers for high-speed trains"] and "Bestimmung der Einfügungsdämpfung einer Schallschutzwand anhand von Messungen in derselben Messebene" [Determination of the insertion loss of a noise barrier based on measurements on the same measuring plane"] are available from department II 2.5 of the UBA (address on page 118). *(II 2.5)*

Societal hearing damage

The "Soziakusis" (societal hearing damage) commission of the UBA which studied, amongst other things, questions related to the limitation of noise levels in discotheques and during large music events re-endorsed its existing position and published a recommendation on limiting noise levels in discotheques in order to prevent hearing damage.

Table 10: Annoyance by noise

Source of noise:	1 Very high annoyance %	2 High annoyance %	3 Medium annoyance %	4 Some annoyance %	5 No annoyance %
Road traffic					
Germany	***6.4***	***11.6***	***19.4***	***26.2***	***36.3***
New Federal States	*7.3*	*12.0*	*20.9*	*28.2*	*31.6*
Old Federal States	*6.2*	*11.5*	*19.0*	*25.6*	*37.7*
Air traffic					
Germany	***2.0***	***3.7***	***9.1***	***17.7***	***67.5***
New Federal States	*1.3*	*1.3*	*5.8*	*17.7*	*73.8*
Old Federal States	*2.2*	*4.4*	*10.0*	*17.7*	*65.7*
Rail traffic					
Germany	***1.7***	***3.1***	***7.3***	***11.3***	***76.6***
New Federal States	*1.9*	*3.5*	*7.8*	*11.1*	*75.8*
Old Federal States	*1.1*	*1.6*	*5.8*	*12.2*	*79.3*
Industry					
Germany	***1.4***	***3.0***	***7.4***	***16.4***	***71.7***
New Federal States	*0.7*	*2.2*	*4.4*	*17.7*	*74.9*
Old Federal States	*1.6*	*3.3*	*8.3*	*16.0*	*70.8*
Neighbourhood					
Germany	***2.2***	***4.3***	***10.7***	***22.3***	***60.4***
New Federal States	*1.6*	*3.3*	*10.9*	*18.9*	*65.3*
Old Federal States	*2.4*	*4.6*	*10.6*	*23.3*	*59.0*

The UBA is continuing its work, together with the Federal Ministry for Health (BMG) and the Bundesärztekammer [German Chamber of Physicians], on an effective information campaign for all the groups concerned on the health risks of loud music. One of these groups is, above all, youths who are particularly at risk because of their music-listening behaviour. Research work by the UBA suggests that youths would be definitely prepared to accept level limits in discotheques and at music events.

The study "Schallpegel in Diskotheken und bei Musikveranstaltungen" [Sound levels in discotheques and at music events] (WABOLU-HEFT 3/00 and 4/00) is available from Werbung + Vertrieb (see box on page 118). *(II 2.5, II 2.1)*

Division II 3:

Water management

Water pollutants in the law on dangerous goods

The law on dangerous goods contains specific provisions for the transport of environmentally harmful goods. On the basis of the *EU Directive 2000/32/EU*, the UBA, the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV) and the Federal Institute for Materials Research and Testing (BAM) have once again updated the list of water pollutants. As a result of this exercise, 353 substances are to be classified as class-9 dangerous substances (dangerous for the environ-

ment) when transported on road and rail. *The list was published in the "Verkehrsblatt" pamphlet (available from Verkehrsblatt-Verlag, Dortmund, telephone 0180/5 34 01 41 (Germany only)).* *(II 3.1)*

Temporary storage of dangerous goods

Provisions concerning the risks caused by dangerous goods that are to be temporarily stored in transit on marshalling yards, in ports or on parking lots at motorway services are contained in both the law on the transport of dangerous goods and in legislation for the storage of such goods. The UBA commissioned the TÜV Nord in co-operation with Prof. Gerald Spindler, Göttingen university, with a legal study on the question as to whether the so-called transport-related temporary storage of dangerous substances is subject to transport law or to the more restrictive requirements of facility-related environmental law. The study concludes that a uniform terminology has not yet been established for describing and controlling cases of "transport-related temporary storage". The author hence tries to develop an independent definition suitable for use in more than just one legislative complex. *This study is titled "Abgrenzung der Anwendungsbereiche des Umweltrechts und des Verkehrsrechts in Bezug auf den sog. transportbedingten Zwischenaufenthalt sowie Darstellung der einschlägigen Sicherheitsanforderungen" [Demarcation of the fields of application of environmental law and transport law with regard to so-called transport-related temporary storage, as well as presentation of the relevant safety requirements] is available on loan under number FKZ 298 48 760 at the UBA library (address on page 118).* *(II 3.1)*

Estimating the hazard for groundwater by organic substances

The Fraunhofer Institute for Environmental Chemistry and Ecotoxicology, Schmallenberg, Germany, was commissioned by the UBA to carry out model calculations in order to estimate the groundwater hazard potential posed by organic substances. The PELMO model (**Pe**sticide **L**eaching **Mo**del) used in plant protection approval procedures was amended in such a manner that it is possible to calculate not just chromatographic, but also fast substance transport processes through open soil structures, such as animal sets and root courses. Furthermore, this model is also valid for carrier-linked transport processes of organic, non-polar substances into deeper soil levels. Additional adjustments were made with regard to the specific issue of assessing residues, such as sewage sludge. *The final report is available on the Internet at www.umweltbundesamt.de/wasser, key word: "Publications – Immissions of substances into waters". It is also available on loan under number FB 000103 at the UBA library (address on page 118).* *(II 3.1)*

International flood protection at the Oder

The Oder flood in summer 1997 showed that protective measures in the Oder basin which is part of the German, Polish and Czech territories is an important topic of environmental policy. Protective measures of this kind can only be successful if this effort is co-ordinated at an international level. In order to improve the mutual understanding of the different legal traditions and administrative structures in the bordering states, the UBA has commissioned a comparative study of national and international laws on flood protection in the three states. This study was prepared by the Internationales Hochschulinstitut Zittau [Zittau International University Institute] with the participation of experts from Poland and the Czech Republic. *The study titled "Gewässerschutz und Hochwasserschutzrecht – Ein Vergleich zwischen Deutschland, Polen und Tschechien" [Protection of waters and flood protection law – a comparison between Germany, Poland and the Czech Republic] was published within the scope of the "Gabler Edition Wissenschaft – Studien zum internationalen Innovationsmanagement" of Deutscher Universitätsverlag and is available at book stores (ISBN 3-8244-7286-4).*
(II 3.1)

Emission inventory "water"

In the past, industrial and municipal point sources of waste water accounted for the greater part of water pollution. Although waste water treatment in Germany is today ensured at a largely nationwide level, many substances are still discharged by factories and municipalities into waters. Diffuse forms of discharge have become increasingly important – with negative consequences for water quality.

On behalf of the Federal Environmental Agency (UBA), the Fraunhofer Institute for Systems and Innovation Research (FhG-ISI), Karlsruhe, Germany, prepared the first nationwide map of pollutant im-

missions and of the relevant paths of immissions into waters. Direct industrial and municipal, as well as diffuse pollutant immissions into waters were compiled for Germany and broken down in terms of sources (industries) and emission paths, as well as the major watersheds and basins, i.e. Danube, Rhine, Ems, Weser, Elbe, Oder, North Sea and Baltic Sea.

The reference periods for this inventory are the years 1993 to 1997 for the diffuse and municipal immissions, and the year 1997 for direct industrial immissions. The inventory covers nitrogen, phosphor, adsorbable, organically bound halogens (AOX) as well as the heavy metals arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc (table 11).

The high rank which diffuse immissions have today is reflected by both nutrients and heavy metals. With the exception of halogen-organic compounds, emissions from municipal sewage treatment plants are substantially higher than direct immissions from industrial sources. However, the share of direct industrial sources in the immissions from communal sewage treatment plants should not be underestimated. Figure 29 shows the distribution of immissions to basins and the different immission paths by the example of the phosphor parameter. *The study "Emissionsinventar Wasser für die Bundesrepublik Deutschland" [Emission inventory "water" for the Federal Republic of Germany (TEXTE 53/00) is available from Werbung + Vertrieb (see box on page 118).* *(II 3.2)*

Identification of harmful substances in waters

Article 16 of the *EU framework directive on water policy* (refer to chapter 9) provides community-wide definitions for quality standards and emission limits for a selected number of prioritary substances. The EU Commission has developed a first proposal in which 32 substances and substance groups were identified as prioritary (table 12).

The ranking is based on the hazard potential of the substances in question (effect on aquatic organisms and on man), on the findings of monitoring programmes for these substances in waters, as well as further established factors which indicate a widespread pollution situation. This includes production data and environmental distribution patterns. The OSPAR Commission's (refer to chapter 1) strategy for putting an end to such emissions and losses of hazardous substances played an important role during the final negotiations on the directive on water policy. The selection method adopted by OSPAR is based on the properties of over 180,000 substances. Due to a lack of monitoring data from the marine environment, the importance of these substances had to be estimated in most cases on the basis of their occurrence using models based on production. The present proposal list contains 27 substances of which 15 are already identified. Twelve substances were newly selected.

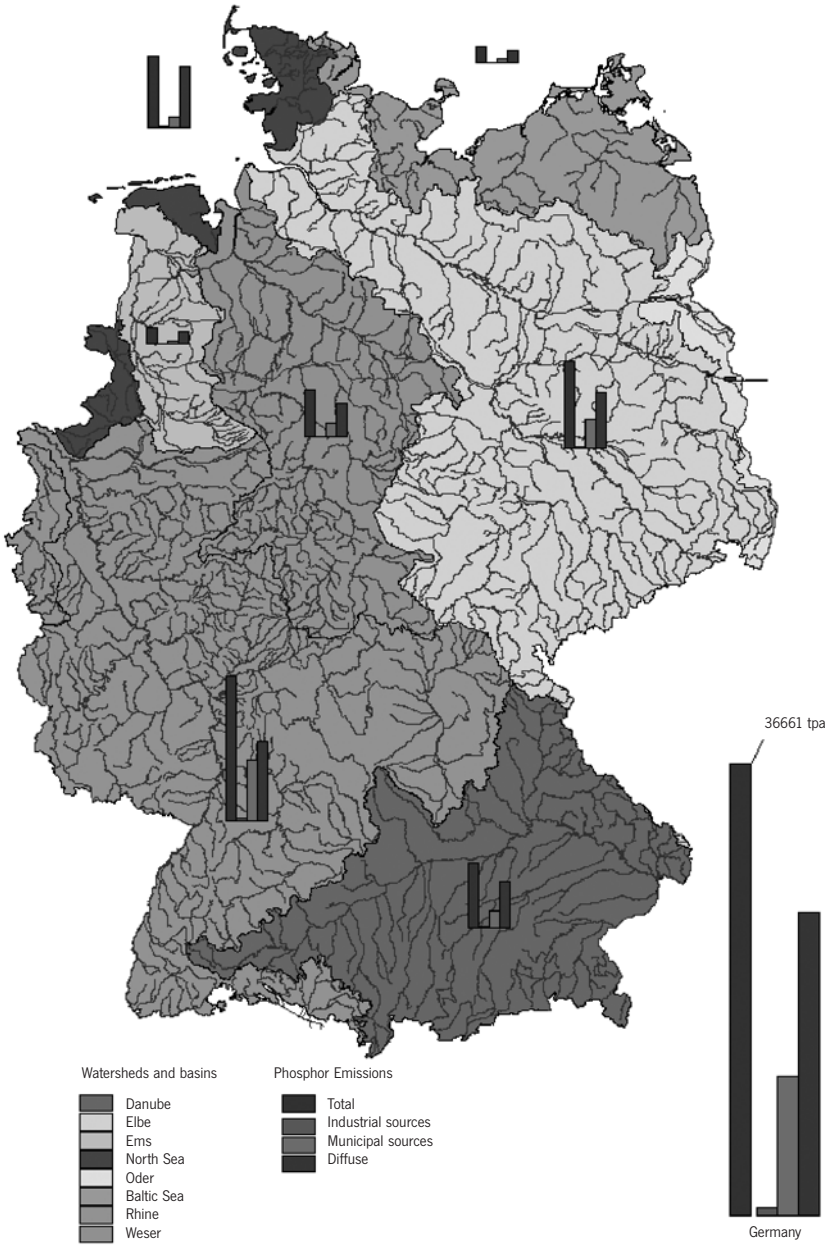
The OSPAR strategy was addressed by the directive on water policy in that the list of prioritary substances ad-

Table 11: Immissions of pollutants from industrial and municipal sources as well as from diffuse sources 1993–1997

	N tpa	P tpa	AOX tpa	As kgpa	Cd kgpa	Cr kgpa	Cu kgpa	Hg kgpa	Ni kgpa	Pb kgpa	Zn kgpa
Industrial immissions	27,015	671	416,9	1,824	1,016	20,435	32,646	223	22,659	23,752	159,099
Municipal immissions	204,860	11,350	419,9	–*	3,049	49,173	123,994	2,773	85,634	38,679	689,620
Diffuse immissions	586,280	24,640	–*	–*	14,377	351,125	604,870	4,010	281,596	442,496	3,378,559
Total immissions	818,135	36,661	–*	–*	18,441	420,732	761,510	7,006	389,890	504,927	4,227,279

* No result for lack of data

Figure 29: Phosphor immissions into German waters



ditionally identifies "prioritary hazardous substances" which are subject to a more restrictive reduction target. Emissions and losses of these substances must be reduced to zero within a maximum period of 20 years. The selection of substances for the list of prioritary substances, including prioritary hazardous substances, is due to be finalized in summer 2001. *(II 3.2)*

Disinfectants in hospitals

The use of disinfectants in hospitals is necessary in order to counteract the risk of infection for patients and medical personnel. Besides the desired, disinfecting action, however, there is also a potential risk for man and the environment that needs to be considered.

Within the scope of the Environmental Research Plan (UFOPLAN), Hydrotox GmbH, Freiburg, has set up a balance of waste-water-relevant surface, instrument and skin disinfectants for several hospitals. The average total consumption amounted to 4.4 grams per bed per day.

The ecotoxicity of hospital waste water which is, amongst other things, due to the use of disinfectants is completely eliminated by municipal sewage treatment plants. However, it is still unclear whether concentrations affecting the bacterial floral exist locally in the upstream sections of sewage treatment plants. *The study titled "Umweltverträgliche Desinfektionsmittel im Krankenhausabwasser" [Environmentally compatible disinfectants in hospital waste water] (Texte 1/00) is available at Werbung + Vertrieb (see box on page 118).* *(II 3.2)*

Table 12: List of prioritary substances proposed by the European Commission

(1) *Alachlor*
(2) *Anthracen*
(3) *Atrazine*
(4) *Benzene*
(5) *Brominated diphenyl ethers*
(6) *Cadmium and cadmium compounds*
(7) *C_{10-13}-chloralkanes*
(8) *Chlorfenvinphos*
(9) *Chlorpyrifos*
(10) *Dichloromethane*
(11) *1,2-dichlorethane*
(12) *Bis(2-ethylhexyl)phthalat (DEHP)*
(13) *Diurone*
(14) *Endosulphane (alpha-endosulphane)*
(15) *Hexachlorobenzene*
(16) *Hexachlorobutadiene*
(17) *Hexachlorocyclohexane (gamma-isomer, lindan)*
(18) *Isoproturone*
(19) *Lead and lead compounds*
(20) *Mercury and mercury compounds*
(21) *Naphthaline*
(22) *Nickel and nickel compounds*
(23) *Nonylphenoles (4-(para)-nonylphenole)*
(24) *Octylphenoles (4-tert-octylphenole)*
(25) *Polyaromatic hydrocarbons (Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Fluoranthene Indeno(1,2,3-cd)pyrene)*
(26) *Pentachlorobenzene*
(27) *Simazine*
(28) *Pentachlorophenole*
(29) *Tributyl tin compounds (Tributyl tin cation)*
(30) *Trichlorobenzenes (1,2,4-trichlorobenzene)*
(31) *Trichlormethane (chloroform)*
(32) *Trifluraline*

Requirements for the offshore oil and gas industry

In the *OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic* (refer to chapter 1), the signatory states undertook to take all steps necessary to protect the marine environment against the harmful consequences of human activity. On 30 June 2000, the OSPAR Commission adopted detailed rules for the offshore oil and gas industry with regard to the use and immission of offshore chemicals, hydraulic fluids and cuttings:

- Recommendation 2000/4: Harmonised Offshore Chemical Notification Format.
- Decision 2000/2: Harmonised Mandatory Control System for the Use and Reduction of Discharge of Offshore Chemicals.

The aim is to replace offshore chemicals with a particularly high environmental relevance, which are used in oil and gas extraction and which are partially released into the oceans, using less harmful or, preferably, harmless substances. For this purpose, offshore chemicals are assessed in terms of their toxicity, accumulation and persistence and suitable measures are subsequently derived. These measures are, in detail: approval, substitution with alternative substances, approval for a limited term, or disapproval. The UBA was involved in the development of the technical basis.

Another requirement concerns the reduction of the discharge of cuttings containing oil-based scavenging fluids or scavenging fluids with an organic phase (based, for example, on mineral oils, olefins and esters). According to OSPAR decision 2000/3 on the "Use of Organic-Phase Drilling Fluids (OPF) and the

Discharge of OPF-Contaminated Cuttings", drilling fluids with an organic phase require prior approval for their use. The criteria of decision 2000/2 on offshore chemicals, the best practices available and a waste disposal hierarchy are to be adopted in this respect.

Offshore wind power plants

Fuelled by subsidies for offshore wind farms under the *Renewable Energy Sources Act* (refer to page 107), approvals were applied for in the year 2000 for more than 2,000 wind power units covering a surface area of 2,000 square kilometres in the offshore area of the North Sea and the Baltic Sea. The responsibility for approvals of facilities within the 12-nautical-mile zone rests with the coastal states, whilst the Federal Maritime and Hydrographic Agency of Germany (BSH) is responsible for the exclusive economic zone (i.e. the 12-nautical-mile to 200-nautical-mile zone). No offshore wind power stations have been approved as yet in Germany.

The UBA is one of the institutions consulted by the BSH in its approval process. In view of the fact that expanding the exploitation of wind energy is a major point of interest in environmental policy, and further considering the fact that there are currently no satisfactory theoretical answers to important questions concerning environmental repercussions on specific offshore sites in the North Sea and Baltic Sea, the UBA has advocated an approach of initially setting up smaller pilot facilities in order to obtain site-specific scientific results on aspects of environmental protection and nature preservation. A decision on further expansion projects and the related applicable conditions is not possible until the results are evaluated with regard to the complexity of a project, as well as measures for reducing and avoiding burdens. In the interest of protecting the maritime environment, the UBA hence considers it to be appropriate to adopt the procedures and methods laid down by the legal principles of the environmental impact assessment process because the establishment and operation of offshore wind farms mean a large-area and long-term intervention in the maritime environment.

In order to support the UBA in its work, the research project titled "Untersuchungen zur Vermeidung und Verminderung von Belastungen der Meeresumwelt durch Offshore-Windenergieanlagen im küstenfernen Bereich der Nord- und Ostsee" [Studies on the avoidance and reduction of pollution in the maritime environment by offshore wind farms in the North Sea and Baltic Sea] was launched in November 2000. This project is being carried out by an interdisciplinary project team headed by the Alfred Wegener Institute for Polar and Marine Research (AWI). Focal issues of the project deal with resting and migrant birds, seabed fauna and fish, sound propagation and sea mammals. The collision risk for vessels is another issue that is being addressed. *(II 3.3)*

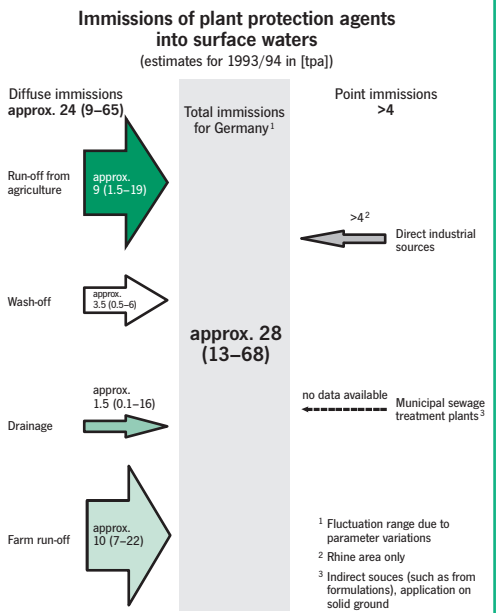
Surface water pollution by active ingredients of plant protection agents

The importance of plant protection agents for water quality shortcomings is increasingly being understood. A test of the targets for active ingredients of plant protection agents relevant for water resources management showed that during the period from 1996 to 1998 the targets for 5 of the 38 active ingredients were exceeded frequently and for another 27 active ingredients occasionally (refer to the UBA's 1999 annual report, page 60 and following). Limit value violations were detected at two thirds of the measuring points.

A study commissioned by the UBA and headed by researchers at Gießen University used mathematical models in order to investigate the causes. For the 42 active ingredients of plant protection agents, which accounted for the largest part of agricultural use in 1993/94, immissions were calculated to total around 30 tonnes per day (tpd) with a relatively large uncertainty range of between 10 and 70 tpd. This corresponds to around 0.1 % of the quantities applied. Figure 30 shows that surface run-off and volumes discharged at farms are the most important immission paths. The burdens of German rivers are in the same order of magnitude as the immissions calculated in the model.

Substantial scouring rates are found on wine-growing land, in fertile plains and areas with loessic soil, as well as in marshy areas with a high percentage of row cultures (sugar-beet, corn (maize)), as well as in low mountain ranges with unfavourable climatic conditions and agricultural use (figure 31). Farm run-off accounts for as much as 90 % in the south and south-west of Germany where the field spraying density is clearly above average and amounts to a multiple of the values in east Germany. Run-off is a factor to be considered wherever soils with a high leaking potential in river plains were drained (such as in the Mün-

Figure 30: Immissions of plant protection agents into surface waters



sterland region, in the Upper Rhine rift valley and in the Lausitz area). Wash-off is very important in fruit farming areas in marshlands with their dense network of drainage trenches. Monitoring programmes and intensive advisory efforts should hence concentrate on these areas with a special focus on the hazards to waters typical for these regions. *The study titled "Schätzung der Einträge von Pflanzenschutzmitteln aus der Landwirtschaft in die Oberflächengewässer Deutschlands" [Estimated immissions of plant protection agents from agriculture into Germany's surface waters] (BERICHTE 3/00) was published by Erich Schmidt Verlag, Berlin, and is available at bookstores (ISBN 3-503-05865-6).*

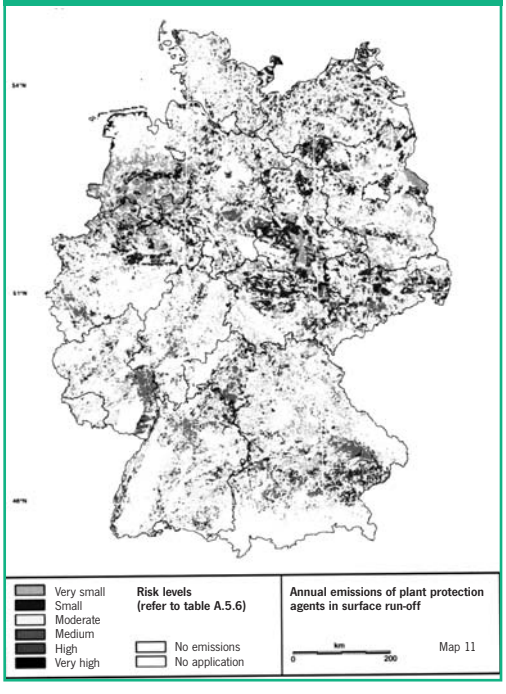
(II 3.4)

Quality targets for the protection of surface waters

For more than ten years, the UBA has been co-operating closely with Länderarbeitsgemeinschaft Wasser (LAWA) in developing targets for dangerous substances in order to protect aquatic environments and certain uses, such as drinking-water supplies and fisheries. Up to now, targets have been developed for 28 industrial chemicals, 6 heavy metals and around 40 pesticides which are being regularly monitored for compliance or limit-value violations at the measuring stations of LAWA's measuring network. The results suggest that problems exist, in particular, in the case of plant protection agents and heavy metals, whereas industrial chemicals account for only a small portion (refer to the UBA's 1999 annual report, page 60 and following).

Pursuant to certain requirements of *the Council Directive on pollution caused by certain dangerous substances released into the environment of the community (76/464/EEC)*, quality targets were developed for the first time which were subsequently adopted in a *sample ordinance of the Federal States for reducing pollution of waters through programmes and quality targets for certain dangerous substances*. The quality targets consider "aquatic communities" and "human health" as assets worthy of protection. In line with the precautionary principle, the more critical asset was taken as the basis for the relevant quality target. The technical requirements for defining the various quality targets were orientated towards national criteria (defined within the scope of legislation for chemicals and plant protection agents) as well as international criteria (laid down within the scope of the Organization for Economic Cooperation and Development, OECD, as well as EU legislation for the approval

Figure 31: Annual discharge of plant protection agents in surface run-off



of existing substances and plant protection agents) for the evaluation of substances. Furthermore, the quality targets are also in conformity with the EU framework directive on water policy (refer to chapter 9).

The quality targets are concentration values for the characteristics of the water or of the particles suspended in water. Compliance with the quality targets is determined on the basis of the mean value as the annual characteristic value. This corresponds to the provisions of the directive.

The following quality targets are based on evaluations of the aquatic ecotoxicity, with two rules being adopted with a view to drinking-water supply as an asset to be protected and upper limits being defined as follows:

- an upper limit of 0.1 microgramme per litre (µg/l) for plant protection agents in each case, irrelevant of whether the ecotoxicological requirements for plant protection agents lead to higher values,
- an upper limit of 10.0 µg/l for non-natural dangerous substances in each case, irrelevant of whether the ecotoxicological requirements for plant protection agents lead to higher values.

First evaluations based on water quality data gathered from 1996 to 1998 showed that for a total of 17 of the 99 EC substance numbers (table 13) the quality targets were violated at individual measuring points of the LAWA measuring network. Of the eight plant protection agents, the two active ingredients Disulfoton and Mevinphos had not been granted approval. *(II 3.4)*

Research activities for implementing the EU framework directive on water policy

The *EU framework directive on water policy* (refer to chapter 9) which has been in effect since 22 December 2000 provides for a comprehensive biological evaluation of waters orientated towards the typical communities of the particular natural space. Based on a systematic description of the alga (phytoplankton) suspended in the water, the large water plants (macroflora), the invertebrates living on the bottom of waters (macrobenthos) and fish fauna, a five-stage ecological classification of flowing waters and lakes is made with a view to existing human (anthropogenic) influences. Class I corresponds to the condition mostly free from anthropogenic influences (high water quality), whilst class II corresponds to the quality target of the EU framework directive on water policy (good water quality).

As yet, Germany has no methods that meet with the criteria and specifications of the EU framework directive on water policy. This is why the UBA is sponsoring two projects for the example-orientated biological evaluation of flowing waters on the basis of the macrozoobenthos. Further projects for developing evaluation systems for water flora (macrophytes, phytobenthos), phytoplankton and fish fauna are being financed by Länderarbeitsgemeinschaft Wasser (LAWA) and the Federal Ministry of Education and Research (BMBF).

Besides biology, the chemical condition of waters is another important aspect for implementing the EU framework directive on water policy. Another UBA project is currently underway in order to determine the physical and chemical reference conditions in the different types of waters. The directive provides that the repercussions of human activity on the condition of surface waters be monitored. Further studies were hence initiated in order to identify significant anthropogenic burdens and potential hazards for the good quality of waters. The EU framework directive on water policy permits member states to identify "heavily modified waters" for which the ecological evaluation and the resultant plans of action are orientated towards the "highest ecological potential" rather than towards the reference condition. The EU Commission has initiated a project for developing more precise criteria for waters to be identified as "heavily modified". This project is managed jointly by the UBA (for Germany) and the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER), as well as the Environment Agency for England and Wales (for the United Kingdom). This project that was launched in April 2000 includes a number of case studies of flowing waters in different European countries, including three UBA-funded case studies of one large, one medium-sized and one small flowing water with different forms of intended use. *(II 3.4)*

Plant protection agents found in the Federal States

Plant protection agents can only be approved for use in agriculture if no harmful effects on ground water are to be expected when these substances are used

Table 13: Quality targets for substances under the Council Directive on pollution caused by certain dangerous substances released into the environment of the community

EU No.	Substance name	Unit
2	2-amino-4-chlorophenol	10 µg/l
3	Anthracene	0.01 µg/l
4	Arsenic	40 mg/kg
7	Benzene	10 µg/l
8	Benzidine	0.1 µg/l
9	Benzylchloride (alpha-chlortoluene)	10 µg/l
10	Benzyliden chloride (alpha,alpha-dichlortoluene)	10 µg/l
11	Biphenyl	1 µg/l
14	Chloral hydrate	10 µg/l
15	Chlordane	0.003 µg/l
16	Chloroacetic acid	10 µg/l
17	2-chloroanilin	3 µg/l
18	3-chloroanilin	1 µg/l
19	4-chloroanilin	0.05 µg/l
20	Chlorobenzene	1 µg/l
21	1-chloro-2,4-dinitrobenzene	5 µg/l
22	2-chloroethanol	10 µg/l
24	4-chloro-3-methylphenol	10 µg/l
25	1-chloronaphthalin	1 µg/l
26	Chloronaphthaline (technical mixture)	0.01 µg/l
27	4-chloro-2-nitroanilin	3 µg/l
28	1-chloro-2-nitrobenzene	10 µg/l
29	1-chloro-3-nitrobenzene	1 µg/l
30	1-chloro-4-nitrobenzene	10 µg/l
31	4-chloro-2-nitrotoluene	10 µg/l
32	Chloronitrotoluenes (other than No. 31) [1]	1 each µg/l
33	2-chlorophenol	10 µg/l
34	3chlorophenol	10 µg/l
35	4-chlorophenol	10 µg/l
36	Chloroprene (2-chlorbuta-1,3-diene)	10 µg/l
37	3-chloropropene (allyl chloride)	10 µg/l
38	2-chlorotoluene	1 µg/l
39	3-chlorotoluene	10 µg/l
40	4-chlorotoluene	1 µg/l
41	2-chloro-p-toluidine	10 µg/l
42	Chlorotoluidines (other than No. 41)[2]	10 each µg/l
43	Coumaphos	0.07 µg/l
44	Cyanurchloride (2,4,6-trichloro-1,3,5-triazine)	0.1 µg/l
45	2,4-D	0.1 µg/l
47	Demeton and compounds[3]	0.1 each µg/l
48	1,2-dibromethane	2 µg/l
49–51	Dibutyl tin cation	0.01 µg/l 100 µg/kg
52	Dichloranilines[4]	1 each µg/l
53	1,2-dichlorobenzene	10 µg/l
54	1,3-dichlorobenzene	10 µg/l
55	1,4-dichlorobenzene	10 µg/l
56	Dichlorobenzidines	10 µg/l
57	Dichlorodiisopropyl ether	10 µg/l
58	1,1-dichloroethane	10 µg/l
60	1,1-dichloroethylen (vinylidene chloride)	10 µg/l
61	1,2-dichloroethylen	10 µg/l
62	Dichloromethane	10 µg/l
63	Dichloronitrobenzenes[5]	10 each µg/l
64	2,4-dichlorophenol	10 µg/l
65	1,2-dichloropropane	10 µg/l
66	1,3-dichloropropane-2-ol	10 µg/l
67	1,3-dichloropropene	10 µg/l
68	2,3-dichloropropene	10 µg/l
69	Dichloroprop	0.1 µg/l
72	Diethylamine	10 µg/l
73	Dimethoate	0.1 µg/l
74	Dimethylamine	10 µg/l
75	Disulfoton	0.004 µg/l
78	Epichlorohydrine	10 µg/l
79	Ethyl benzene	10 µg/l
82	Heptachlorine (+Heptachloroepoxide)	0.1 µg/l
86	Hexachloroethane	10 µg/l
87	Isopropylbenzene	10 µg/l
88	Linuron	0.1 µg/l
90	MCPA	0.1 µg/l
91	Mecoprop	0.1 µg/l
93	Methamidophos	0.1 µg/l
94	Mevinphos	0.0002 µg/l
95	Monolinurone	0.1 µg/l
96	Naphthalene	1 µg/l
97	Omethoate	0.1 µg/l
98	Oxydemeton-methyl	0.1 µg/l
99	PAH[6] topically	0.1 µg/l
101	PCB (including PCT)[7]	20 each µg/kg
103	Phoxim	0.008 µg/l
104	Propanil	0.1 µg/l
105	Pyrazone (chloridazone)	0.1 µg/l
107	2,4,5-T	0.1 µg/l
108	Tetrabutyl tin	0.001 µg/l 40 µg/kg
109	1,2,4,5-tetrachlorobenzene	1 µg/l
110	1,1,2,2-Tetrachloroethane	10 µg/l
112	Toluene	10 µg/l
113	Triazophos	0.03 µg/l
114	Tributyl phosphate (phosphoric acid tributyl ester)	0.1 µg/l
116	Trichlorofon	0.002 µg/l
119	1,1,1-trichloroethane	10 µg/l
120	1,1,2-trichloroethane	10 µg/l
122	Trichlorophenols[8]	1 each µg/l
123	1,1,2-trichlorotrifluorethane	10 µg/l
128	Vinyl chloride (chlorethylene)	2 µg/l
129	Xylenes[9]	10 each µg/l
132	Bentazone	0.1 µg/l

1 2-chloro-4-nitrotoluene, 2-chloro-6-nitrotoluene, 3-chloro-4-nitrotoluene, 4-chloro-3-nitrotoluene, 5-chloro-2-nitrotoluene

2 3-chloro-o-toluidine, 3-chloro-p-toluidine, 5-chlor-o-toluidine

3 Demeton, Demeton-o, Demeton-s, Demeton-s-methyl, Demeton-s-methyl-sulphone

4 2,4-&2,5-dichloroanilin (2 µg/l), 2,3-dichloroanilin, 2,4-dichloroanilin, 2,5-dichloroanilin, 2,6-dichloroanilin, 3,4-dichloroanilin, 3,5-dichloroanilin

5 1.2-dichloro-3-nitrobenzene, 1.2-dichloro-4-nitrobenzene, 1.3-dichloro-4-nitrobenzene, 1.4-dichloro-2-nitrobenzene

6 Total Benzo-b-fluoranthene, benzo-g.h.i-perylene, benzo-k-fluoranthene, fluoranthene (or 0.025 µg/l each); indeno-1.2.3-cd-pyrene 0.025 µg/l; benzo-a-pyrene .01 µg/l

7 PCB-101, PCB-118, PCB-138, PCB-153, PCB-180, PCB-28, PCB-52

8 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,3,4-trichlorophenol, 2,3,5-trichlorophenol, 2,3,6-trichlorophenol, 3,4,5-trichlorophenol

9 1.2-dimethylbenzene, 1.3-dimethylbenzene, 1.4-dimethylbenzene

correctly. Comprehensive groundwater analysis programmes by the Federal States are in place in order to monitor this condition.

Since 1989, the Federal States have been sending their field data to the UBA on an annual basis so that this information can be compiled and used by the evaluation and approval institutions for plant protection agents.

The drinking-water limit value which is used as the evaluation basis for increased pollution levels is still often exceeded with atrazine and its metabolites. Other substances for which increased concentrations are frequently reported by the Federal States include Bromacil, diurone, Lindan, Mecoprop, 1,2-dichloropropane and 2,6-dichlorbenzamide.

Some of the active ingredients concerned are subject to a ban on use. These are: atrazine (since 1991), Bromacil and 1,3-dichloropropane. The occurrence of these active substances and their pollution and metabolites clearly show that groundwater pollution has a long-lasting effect. The use of Lindan is also restricted until 2001, after which time it will be prohibited. *(II 3.5)*

Division II 4:

Hygiene of drinking water and bathing pool water

WHO Collaborating Centre for Research in Drinking-water Hygiene

The WHO Collaborating Centre for Research in Drinking-water Hygiene has been in operation since 1995. This centre is located at the Bad Elster branch of the Federal Environmental Agency (UBA).

Topical issues of the joint work with the WHO include the ongoing revision of and amendment to WHO's drinking-water guidelines, scientific studies of microbial risks in cases of impaired drinking-water quality, research work into new control approaches for existing communication paths of certain infectious diseases through drinking water, harmonisation of microbial testing methods, the continuation of studies on origin, occurrence and nature of blue-green algae poisons, as well as the development of environmental protection concepts in order to protect drinking-water resources against microbial contamination.

UBA's Bad Elster branch, where the WHO Collaborating Centre for Research in Drinking-water Hygiene is located. (Photo: UBA/Piepenburg)

Structure and contents of the third edition of the WHO drinking-water guidelines were co-ordinated in June 2000 during a WHO conference under the technical and organizational responsibility of the UBA.
(II 4.1/WHO Wasser)

Drinking-water commission of the UBA

In 2000, the drinking-water commission (TWK) of the UBA worked very intensively on the implementation of the *EU Directive on drinking water (98/83/EU)* in German law. It was hence possible to submit the amended *Drinking Water Ordinance (TrinkwV,* refer to chapter 9) to the Bundesrat as the second chamber of the German parliament in autumn 2000. The Bundesrat adopted the ordinance after revision and with a resolution requesting the Federal government to seek for ways to treat certain cases, which are currently punishable as an offence, as petty offences which would only be subject to fines.

A crucial aspect of the revised *Drinking Water Ordinance* is the change of paradigm from "water as a foodstuff" to "water for human consumption" This reflects the real, comprehensive importance of drinking water as a vital substance to which there is no alternative because of its universal use. Drinking water must hence be suitable for human consumption, as well as clean and free from harmful contents, especially from the point of view of hygiene. Its quality is oriented towards groundwater from the natural water circulation. *(II 4)*

Division II 5:

Soil

Technical advisory committee on soil analyses

Appendix 1 to the *Federal Soil Protection and Contaminated-sites Ordinance* (BBodSchV) provides for the establishment of a board of specialists from the Federal and Federal-state governments for the application of tried-and-tested, advanced methods of investigating soils, contaminated sites and abandoned dumps. To this effect, the Federal Ministry for the Environment (BMU) has set up the "technical advisory committee on soil analyses" at the UBA. This committee is currently made up of three working groups:

- Soil sampling,
- Processes and methods for quantifying substances in soils,
- Quality assurance and uncertainty of results of soil analysis methods.

The evaluation of existing methods pursuant to appendix 1 to the *Federal Soil Protection and Contaminated-sites Ordinance* (BBodSchV) must also be oriented towards the Bundesrat's requirements.

An amendment to the list of prevention values, as well the list of trigger values and intervention values for the "soil/man", "soil/plant" and "soil/groundwater" paths of action implies the definition and annotation of suitable analytical methods. In a work programme that is to be updated annually, the advisory committee will define concrete tasks, taking the applicable implementation requirements into consideration. *(II 5.1)*

NATO study on the rehabilitation of contaminated sites

Within the scope of the "NATO Committee on the Challenges of Modern Society" (NATO/CCMS, refer to chapter 1), phase III of the international pilot study "Innovative techniques for rehabilitating contaminated sites" was launched in 1998. This five-year pilot study is jointly managed by the US (Environmental Protection Agency, EPA), the Netherlands (Netherlands Organization for Applied Scientific Research, TNO) and Germany (UBA). By invitation of the Federal Ministry for the Environment and the UBA and with the support by the Hessen Ministry for the Environment, Agriculture and Forestry, the 3rd international conference of the pilot study met from 25 to 30 June 2000 in the Parliament of the Federal State of Hessen in Wiesbaden. During the conference, the more than 20 participating states presented and discussed projects in which innovative techniques for soil and groundwater rehabilitation are being tested and demonstrated. Besides the issues of "reactive walls" and "natural conservation and extraction", this year's conference also focused on the subject of "decision-making tools". *(II 5)*

Contaminated-sites information system (ALIS)

The research project on the "Establishment of a contaminated-sites information system" was completed

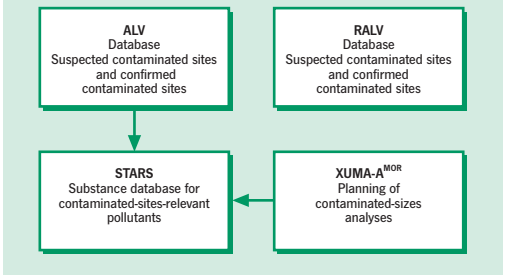
after a four-year term in September 2000. The company Stoller Ingenieurtechnik (SIG), Dresden, was commissioned to develop and implement a contaminated-sites information system (ALIS).

The basis of implementation was a co-operative exchange of information between various agencies of Federal and Federal State governments. The data that was edited and compiled to this effect was supplied by:

- the Hanover Inland Revenue Service (OFD)
- the Baden-Württemberg Federal-State institute for environmental protection (LfU),
- the Saxone Free-State Agency for environmental protection and geology (LfUG),
- the North-Rhine Westphalia Federal State Agency for the envrionment, and
- the BMU (Federal Ministry for the Environment)/UBA.

Four databases and knowledge-based applications resulted from this effort (figure 32) which are briefly outlined in the following.

Figure 32: Contaminated-sites information system ALIS



STARS – (substance database for contaminated-sites-relevant pollutants): This database currently contains data for some 1,000 substances for which around 60,000 features can be researched and retrieved. Information concerning the features of substances is available in the following categories:

- physical and chemical parameters,
- envionmental behaviour,
- toxicology,
- ecotoxicology,
- substance-specified rules, codes and standards,
- industrial safety,
- trigger values, intervention values and prevention values pursuant to the *Federal Soil Protection and Contaminated-sites Ordinance*,
- Federal-State lists,
- background values for inorganic and organic substances in soils, etc.

The original source is listed for all data.

A STARS demonstration version can be viewed on the Internet at: www.stoller-dresden.de/stars.html.

RALV – (database of suspected contaminated sites in Germany): Data is currently available for around 6,000 sites of which some 3,300 are classified as contaminated military sites or suspected contaminated military sites. The database was made available to the competent Federal State authorities with the state-specific data contents.

ALV – (database of contaminated sites and suspected contaminated sites): The development of the ALV database is based on the RALV database, however, the ALV is a program version without data contents. ALV supports the input and handling of data concerning suspected contaminated sites and historical pollutions. In this way, it is possible to handle and edit historical exploration results (including, but not limited to, geology, hydrogeology, uses of sites and ownership conditions), examination results of individual sites, information concerning the rehabilitation level (including the type of rehabilitation work concerned), as well as information concerning the status of action to be taken or completed.

XUMA-A^{MOR} – (a program for planning analyses for the examination of contaminated military sites, contaminated east German industrial and military sites): XUMA-A^{MOR} supports the development of analysis plans on the basis of available data on processes and production methods. Input materials, intermediate and waste, as well as decomposition products are correlated with each other, with time references and with media-related examination parameters. Furthermore, information and research possibilities are made available for general industry, use and substance descriptions. The development of XUMA-A^{MOR} is based on the XUMA-Analysenplan program that has been available since January 1998. This program was developed in a joint effort of the Baden-Württemberg Federal-State institute for environmental protection (LfU) and the Saxone Free-State Agency for environmental protection and geology (LfUG).

Availability of contaminated-sites programs

The databases were basically designed and implemented as client/sever databases for the ORACLE database management system, and are also used by the UBA in this format. The databases can be transposed to licence-free formats, so that all the applications can also be used on stand-alone PCs. These ALIS databases which are termed "program versions" can be ordered individually or as combinations of two or more databases in program packages (figure 33). *The company Stoller Ingenieurtechnik, Bärensteiner Straße 27-29, 01277 Dresden, Germany, telephone. +49 351/ 2 12 39 30, facsimile: +49 351/ 2 12 39 59, distributes the program versions of ALIS on CD-ROM and updates the databases and programs.* *(II 5.2)*

Figure 33: Program versions of the contaminated-sites information system

Handbuch der Bodenuntersuchung [Soil Analysis Handbook]

Appendix 1 to the *Federal Soil Protection and Contaminated-sites Ordinance (BBodSchV)* states the methods to be used for practical implementation. These methods are compiled in the "Handbuch der Bodenuntersuchung" [Soil Analysis Handbook]. Representatives of the laboratory for soil analyses at the UBA sit on the advisory editing board and in the advisory technical board for soil analyses. The handbook currently contains around 100 procedures (standards, leaflets, guidelines) and is amended every six months by scientifically accepted soil analysis methods. The recommendations by the technical advisory committee for soil analyses (refer to page 75) are a major criteria for selection. *The loose-leaf handbook titled "Handbuch der Bodenuntersuchung – Terminologie, Verfahrensvorschriften und Datenblätter, Physikalische, chemische, biologische Untersuchungsverfahren, Gesetzliche Regelwerke" [Soil Analysis Handbook – terminology, procedures and data sheets, physical, chemical, biological analyses, laws], edited by: Deutsches Institut für Normung, is published by Beuth Verlag, Berlin, Vienna, Zurich (ISBN 3-410-14202-9) and Wiley-VCH, Weinheim (ISBN 3-527-19080-5). It is available at bookstores.* *(II 5.4)*

Division II 6:

Air quality

Effects of air traffic on the stratospheric ozone layer

Can pollutant emissions from aircraft engines above the tropopause, i.e. in middle latitudes in air layers above altitudes of around 10 to 12 kilometres, deplete ozone in the stratosphere? Munich's Ludwigs-Maximilians-Universität looked into this issue for the UBA. Another aspect to be studied was which chemical and physical processes play a role in this respect. The main subject of the research project: which particles are formed in the exhaust stream of aircraft engines and which chemical reactions take place on the surface of these particles? Apart from improved global computer models for simulating the effects of aircraft exhaust gases on the atmosphere, the results suggest that cirrus and condensation trails have without doubt the potential to deplete ozone. However, it is not clear to what extent these processes contribute towards the depletion of stratospheric ozone. How much additional cirrus is produced as a consequence of aircraft exhaust gases remains open. *The final report titled "Auswirkungen der Emissionen des Luftverkehrs oberhalb der Tropopause auf die stratosphärische Ozonschicht" [Effects on the stratospheric ozone layer of air traffic emissions above the tropopause] is available on loan under number FB 000097 at unit II 6.1 of the UBA (address on page 118).* *(II 6.1)*

Environmentally optimised air traffic routes

A research project with which AvioPlan, Munich, was commissioned focused on studies aimed at reducing the impact of air traffic emissions on the climate. Aircraft cruising at altitudes of between 8 and 14 kilometres emit gases and particles directly into the upper troposphere and the lowest stratosphere, thereby influencing atmospheric composition. The model for optimising flight profiles which resulted from this project considers cruising time and in-flight fuel consumption as economic criteria and the climatic effect of the gases emitted as the ecological criterion. The climatic effect includes the effects of carbon dioxide (CO_2, refer to chapter 7), the formation of condensation trails and the chemical effect of emissions which affect, amongst other things, the ozone concentration. *The final report titled "Modellsystem zur routinemäßigen Ermittlung umweltoptimierter Flugstrecken als Beitrag zum Schutz des Klimas" [Model system for the routine determination of environmentally optimised air traffic routes as a contribution towards climate protection] is available on loan under number FB 000030 at the UBA's library (address on page 118).* *(II 6.1)*

Air quality control

The aim of the requirement stating that suitable measuring and evaluation equipment be used pursuant to the ordinances and administrative regulations under the *Federal Immission Control Act (BImSchG)* is to ensure that the measuring requirements laid down in this act are adhered to with sufficient precision. Comprehensive suitability testing is carried out in order to establish whether or not measuring equipment is capable of performing as required for a specific task.

The minimum emission monitoring requirements were updated by revising the applicable laws and subsequent notification of the European Union (EU). These minimum requirements will come into full effect when the *Technical Instructions on Air Quality* and the *Ordinance on Immission Values for Pollutants in Air (22nd BImSchV)* is amended soon.

Although the requirements for air quality cannot be separated from the evaluation of air quality – i.e. the principle of the integrity of limit value and evaluation method – so that final responsibility in this matter must rest with the government, a working group of the Air Quality Control Commission (KRdL) at the German Association of Engineers (VDI) and the German Institute for Standardization (DIN) has been commissioned to define the minimum requirements for immission measuring equipment. Another working group of the Air Quality Control Commission is developing test plans. These are rules as to how the individual minimum requirements of continuous measuring equipment are to be tested experimentally. Both working groups are headed by members of the UBA.

The results of this work have been published in the guidelines *VDI 4202 "Minimum requirements for suitability tests of ambient air measuring instruments"* and *VDI 4203 "Test plans for continuously recording measuring instruments"*.
Two draft guidelines were published already in 2000:

- VDI 4203 sheet 1 (April 2000) deals with the underlying principles of the tests, with the suitability testing procedure and with requirements for testing institutes and reporting.
- VDI 4202 sheet 1 (December 2000) contains minimum requirements for continuously recording, point sampling immission measuring instruments, i.e. equipment based on conventional measuring principles.

The projects to be tackled next are test plans for emission evaluation and immission measuring equipment. The guidelines which are already in place are important for European and international standards because other EU member states also have a keen interest in introducing comparable rules. This trend was also addressed by the European Committee for Standardization (CEN), so that minimum requirements have now been laid down in a host of standards for measuring processes. *The VDI guidelines and draft guidelines are published by Beuth Verlag, Berlin, and are available at bookstores.* *(II 6.3)*

Quality assurance and harmonization of benzene measurements

The *2nd Air Quality Daughter Directive of the EU Air Quality Directive,* which came out in December 2000, contains rules for determining benzene immission burdens and, to this effect, sets forth data quality targets for which quality assurance programmes must be implemented with regard to adherence to the acceptable uncertainty ranges. The benzene limit value totals 5 micrograms per cubic metre ($\mu g/m^3$) as the annual mean value and which

place high demands on field-value quality. Benzene is an air pollutant with a carcinogenic potential.

Comparative measurements by several measuring methods within the scope of intercomparison programmes are an important part of such quality assurance programmes. In 2000, a three-part intercomparison programme for determining benzene in the air was carried out at the technical institute of the EU reference laboratory of the UBA for the national immission measuring stations in the Federal States.

Measuring programme and procedures of parts 1 and 2 were designed for continuous-recording benzene monitoring equipment, whilst part 3 was designed for laboratory routines with active sampling using adsorption tubes, as well as for long-time sampling programmes.

Considering the very low concentration range and the measuring uncertainty of the gas-chromatographic methods, the intercomparison programme can be classified as successful.

Furthermore, the EU reference laboratory itself takes part in international intercomparison programmes. During the second half of 1999, one such international intercomparison programme was staged by standardization institutes in order to validate test gases of benzene, toluene, ethyl benzene or xylene (BTEX). The values measured by the UBA were within the measuring uncertainty of the measured value.
(II 6.3)

Grain size of matter contained in airborne particles

Measurements performed by the UBA's pilot station in Langen over many years revealed an accumulation of various substances contained in airborne particles in different particle sizes as a function of their physical and chemical properties. In order to assess the impact of a chemical substance on humans and the environment, it is important to know whether these substances are contained in fine dust (particle diameter of less than 2.5 micrometers, µm) or in coarse dust (particle size of more than 2.5 µm). Fine-dust particles, when inhaled, penetrate deeply into the lungs and – because of their small dimensions, their light weight and thus because of a long retention time of several days – are transported over long distances. In contrast, coarse-dust particles usually remain lodged in the nose and throat and, when transported in ambient air, normally settle on the ground after a few hours where they unfold their harmful effect in conjunction with pollutants that have already accumulated there.

Organic dust contents are chiefly attached to particles with a diameter of less than 1 µm (submicron range). These are a vast number of not easily volatilised – both not easily and easily water-soluble – organic compounds, such as high-boiling n-alkanes, polycyclic aromates (PAK), carbonic and dicarbonic acids, chlorinated PAHs, chlorinated dibenzofuranes. Soot is also commonly found among fine-dust particles, with organic compounds being attached to (adsorbed by) their surfaces.

The organic compounds contained in the submicron range can be primary aerosols directly from combustion processes, as well as secondary aerosols formed by chemical reactions in the air.

Inorganic acids and salts, which together account for 20 % to 60 % of the fine-dust mass, have particle sizes ranging between 0.3 and 2 µm. Due to their retention time of several days and their origin from anthropogenic and natural sources, these substances occur at a superregional level and, through eutrophization and acid immissions, affect ecosystems, such as the biological diversity of low-nutrient soils.

Coarse-dust particles chiefly contain metal oxides that are released into the environment by abrasion, dust whirl-up and combustion processes. As the retention time of coarse-dust particles in air is less than one day, these particles settle locally or regionally near their sources. Coarse-dust particles, when inhaled, remain lodged in the nose and throat and are mostly discharged through the digestive organs.
(II 6.3)

Information for the public on air pollution

The *Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air* requires that the public be centrally informed on pollutant concentrations in the air. This information for each year must be routinely released during the summer of the subsequent year and for the first time by 19 July 2001 at the latest. In

talks with the Federal State governments, the UBA has achieved that:

- this information is routinely updated and publicised by the UBA via the Internet six times a day at (www.umweltbundesamt.de),
- more detailed information can be additionally obtained from the Federal State governments, and that
- Federal State governments inform the public via the press, radio and TV as soon as the alarm thresholds defined in the directive are exceeded.

(II 6.4)

International ozone workshop

Within the scope of the European Monitoring and Evaluation Program, EMEP, the UBA has staged an international ozone workshop in order to analyse ozone trends. This workshop took place from 9 to 11 November 2000 in Cologne, Germany, and was attended by 47 delegates from 14 countries. The aim was to analyse and interpret the trends of ozone and its precursor substances. Goals, proceedings, events and papers of the workshop are available on the Internet at www.air-information.de. *(II 6.4)*

Ozone exposure in summer 2000

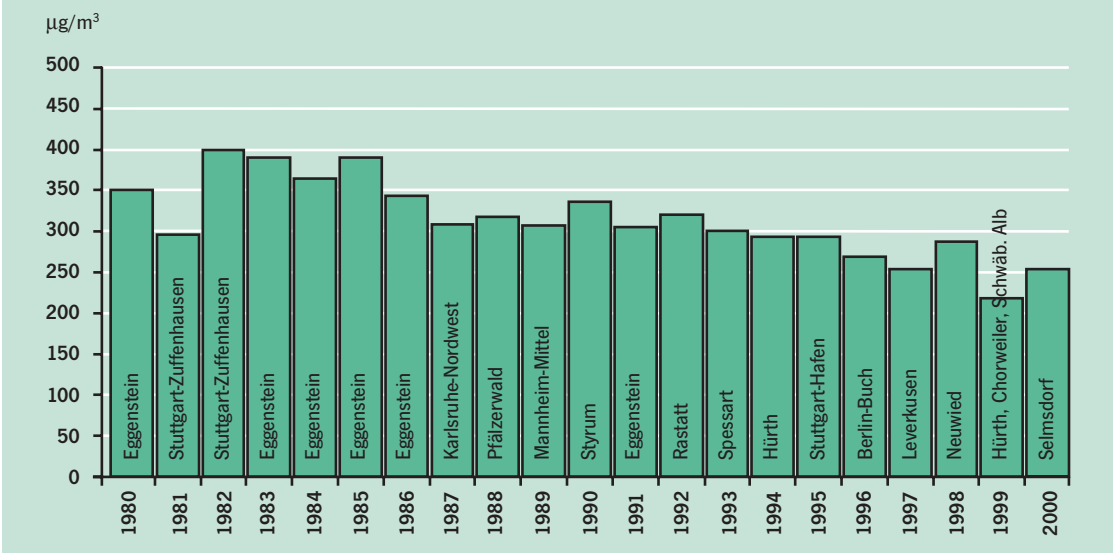
Although ozone values in Germany exceeded a level of 240 micrograms per cubic metre (µg/m³) more frequently in 2000 than in 1999, the trend over the past ten years remains unbroken: peak concentrations of the harmful summer smog are falling (figure 34).

In 2000, the Federal States operated 349 measuring stations for monitoring ozone concentrations. Another 21 stations run by the UBA monitor long-range air pollution.

The one-hour mean value for the information threshold of 180 micrograms per cubic metre of air (µg/m³) – pursuant to the applicable *directive 92/72/EEC on air pollution by ozone* – was exceeded during the months of May, June and August at a total number of 233 of the 370 measuring stations during a period of 1588 hours, distributed over 24 days, whilst in contrast to previous years, the value for triggering the alarm system (360 µg/m³) was not reached.

The data from summer 2000 was also analysed in accordance with the joint standpoint of the Council of the Ministers for the Environment of the European Union with a view to a new EU ozone directive. Similar to the one already in effect, the new directive demands that the public be informed and an alarm generated when certain threshold values are exceeded. Furthermore, target values – compliance with which is to be checked as of 2010 – and long-term targets are defined. In the case of target values and long-term targets, values for protecting human health are distinguished from values for protecting vegetation. The information threshold of 180 µg/m³ (one-hour

Figure 34: Maximum annual ozone concentrations in µg/m³ and measuring stations



mean value) is the same as before. The alarm threshold will be reduced in the new EU directive from 360 µg/m^3 to 240 µg/m^3, with short-time action to be taken after three hours if such action – subject to scrutiny by the member states – is linked to a significant potential for reducing the amount by which the threshold value is exceeded. In summer 2000, the threshold value was exceeded during more than three hours in just a single case.

In the interest of human health, the daily maximum value of ozone concentrations averaged over eight hours should not exceed a value of 120 µg/m^3 in the long term. The target value allows exceptions to this on 25 days per year. This target value (including the exceptions) was adhered to at around three quarters of all the measuring stations in Germany. The assessment thresholds for protecting vegetation are based on the so-called AOT (accumulation over threshold) concept. With this approach, the concentrations above a defined threshold are added up during a defined period of the year and day, i.e. the main growth period. This is the result of the fact that ongoing, extended exposure above a certain pollutant concentration can cause substantial damage to plants. The defined aggregate target value (18,000 µg/m^3 x hours above 80 µg/m^3) was adhered to at 81 % of the German measuring stations.

In order to enable a comparison with previous years, evaluations were finally also based on the criteria of the former *ozone act* which was in effect until 31 December 1999. Although the trigger value of 240 µg/m^3 was reached at eight measuring stations, distributed over four days, the further conditions for triggering an ozone alarm and hence a driving ban would not have been fulfilled on any day in 2000. *Free copies of the short report titled "Ozonsituation 2000 in der Bundesrepublik Deutschland" [Ozone situation in the Federal Republic of Germany in 2000] are available from the Central Answering Service of the UBA (see box on page 118). The ozone forecasts by the UBA (in summer) as well as further information on ozone-related immissions are available on the Internet at www.umweltbundesamt.de/uba-info-daten/daten/aod.htm.* *(II 6.4)*

CO_2 measuring campaign on the Feldberg mountain/Black Forest

A proposal was made within the framework of a research project on measuring climatically relevant gases in order to optimise the sites for this measuring task. The most important climatically relevant gas, i.e. carbon dioxide (CO_2 – refer to chapter 7), was hence measured on the Feldberg mountain in the Black Forest from March to November 2000 parallel to the routine measurements on the Schauinsland peak. This project was expected to clarify whether and to what extent different influences can be found due to local conditions when compared to the Schauinsland peak.

The Schauinsland station is located at an altitude of 1,205 metres above mean sea level, and is surrounded by woods and meadows that are used for agricultural purposes. Measurements on the Feldberg were taken on the radio tower of the Südwestrundfunk (SWR) network at an altitude of 1,500 metres. The radio tower is located above the tree line, and offers unrestricted air flow access from all directions. The Feldberg mountain is located around 10 kilometres air distance to the south east of the Schauinsland peak.

Table 14 shows the results of the measuring campaign in the form of daily mean curves for the individual months.

One can see that the daily trends and CO_2 mixing ratios are hardly any different at the two measuring points during cooler months with less biological activity. Differences set in as vegetation growth begins. However, there are only minimum differences even during summer months as one can see when comparing the monthly mean values and standard deviations in ppm (parts per million).

The campaign on the Feldberg mountain with the reference measurements in relation to the Schauinsland station shows that both places are subject to widely comparable interferences – despite different altitudes and local differences in terms of vegetation and landscape. Changing the place of measurement would hence not produce any qualitative leap for the measuring results. *(II 6.5)*

UV-B measurements

The alarming depletion of the stratospheric ozone layer, chiefly caused by chlorofluorohydrocarbons (CFCs), is very likely to lead to an increase in ultraviolet (UV) B radiation (290 to 320 nanometres, nm) on the earth's surface and hence to a risk for the

Table 14: Monthly daily curves for carbon dioxide on the Schauinsland peak and the Feldberg mountain in the Black Forest for March to November 2000

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.
Schauinsland	376	375	371	367	365	364	366	370	372
Feldberg	376	375	372	370	365	364	365	370	373
Standard Deviations									
Schauinsland	3	3	5	5	5	5	6	4	2
Feldberg	3	3	4	5	4	3	5	3	1

biosphere. Since 1993, the UBA has been running an UV measuring network with four stations together with the Federal Office for Radiation Protection (BfS). The main aim is to determine a long-term trend of UV radiation as a consequence of the depletion of the stratospheric ozone layer which is found even above Germany.

Using a new method developed by the UBA's field station in Langen, it was possible to determine the annual trend of the ozone column density – chiefly stratospheric ozone – at the four stations of the UV measuring network on the basis of global radiation measurements, with the result that an inverse relationship was found to exist between ozone content and UV-B radiation. The measurements at the Schauinsland station in 1999, for example, suggested that a 20 % reduction of the ozone column led to a doubling of radiation with the very short wavelength of 300 nm, whilst the corresponding increase for the entire UV-B radiation between 290 nm and 320 nm totalled just around 20 %.

It is not yet possible to answer the question as to whether and how much UV-B radiation has increased as a consequence of the depletion of the atmospheric ozone layer on the basis of the UV measurements in the UBA/BfS measuring network in view of the short term of just seven years and in light of the considerable natural variability of UV radiation. *For a detailed presentation, please refer to the "Jahresbericht 1999 aus dem Messnetz des Umweltbundesamtes" [1999 annual report from the UBA's measuring network] (TEXTE 58/00). Free copies are available from unit II 6.5 of the UBA (address on page 118).*

(II 6.5)

Department III: Environmentally compatible technologies – procedures and products

Division III 1:

Technology and product evaluation

Biotechnical alternatives to chemical and technical processes

Biotechnical processes make use of the potential of organisms to transform substances. Up to now, biotechnical processes have been used in the chemical industry chiefly in order to rehabilitate contaminated soils or to clean waste water and exhaust air. This is also termed "end-of-pipe" environmental protection. Today, efforts are increasingly being made in order to integrate biotechnological processes right into the production process in order to avoid environmental burdens from the very outset. The buzzword here is: production-integrated environmental protection.

The company Prognos AG, Basle, Switzerland, was commissioned by the Federal Environmental Agency (UBA) to perform a study on how chemical and technical processes can be replaced by biotechnical processes. Using selected basic and fine chemicals as examples, the authors identified 54 substances which are produced on an industrial scale and for which a biotechnological alternative exists. In the case of basic chemicals containing oxygen, these are chiefly alcohols, organic acids and propylene oxide, whilst the only chloroorganic basic chemical identified in this respect was epichlorohydrine. Basic and fine chemicals produced using chlorine include, for instance, not just propylene oxide which was already mentioned, but also vitamin B_2, 2,3-butanediole and L-phenylalanine. *The study titled "Substitution chemisch-technischer Prozesse durch biotechnische Verfahren am Beispiel ausgewählter Grund- und Feinchemikalien" [Substituting chemical and technical processes using biotechnical processes based on the example of selected basic and fine chemicals] (TEXTE 16/01) is available from Werbung + Vertrieb (address: see box).*

(III 1.1)

Comprehensive reports and background information are available on many of the topics. Literature from the Federal Environmental Agency (UBA) can be purchased from Werbung und Vertrieb, Ahornstraße 1–2, 10787 Berlin, telephone +49 30/2 11 60 61, telefax +49 30 2 18 13 79. Material is also available free of charge from the UBA's Central Answering Service, Bismarckplatz 1, 14193 Berlin, telephone +49 30/89 03-2400, 2422, -2304, telefax +49 30 89 03-2912. A directory is also available here free of charge that lists all publications by the UBA. Information concerning the entire range of information available, as well as summaries of selected publications, are also available on the Internet at: www.umweltbundesamt.de, under "Issues".

Investment projects of a demonstration character

The UBA is responsible for the technical supervision and monitoring of the programme pursued by the Federal Ministry for the Environment (BMU) that promotes and subsidizes demonstration projects. Since the launch of this programme in 1979, around 600 projects with a total financial volume of more than EUR 0.87 billion have been subsidized. Subsidies are granted for demonstration projects of a model character which are implemented for the first time on a large technical scale in Germany and which lead to substantial reductions in:

- pollutant emissions into the air, water or soil,
- waste in terms of types and volumes,
- noise emissions or
- harmful effects on soil and their consequences.

These plants and processes must reflect an advanced state of the art, they must feature a new combination of processes in selected applications or they must represent particularly advanced processes which should be integrated into production processes. Table 15 contains all the investment projects approved in 2000. Table 16 shows the projects completed in 2000. *(III 1.1)*

Safety issues with hazardous work process

Prognos AG, Basle, Switzerland, conducted a study together with Eco Team GmbH, Trier, Germany, on the question as to how operator errors can be avoided in conjunction with hazardous work processes. This research project that was commissioned by the UBA focused on the "human factor". Surveys in the chemical industry indicated that operators must be capable of mastering not just regular operational conditions but also unforeseeable conditions. However, whether the requirements placed on operators can be fulfilled in terms of his or her physical and psychological limits is a matter that is rarely examined and which depends to a large extent on the technical system and the organizational environment. The results of the practical tests are documented in a guideline which describes man's abilities and limits, and additionally contains check-lists which can be used for measuring the "human factor" in working life. This concerns, for example, aspects of plant design, control-room design and personnel selection. *The research report titled "Strategien zur Verhinderung von Fehlbedienungen in verfahrenstechnischen Anlagen" [Strategies for preventing operator errors in processing plants] (TEXTE 11/01) is available from Werbung + Vertrieb (address: page 146). It is also available on the Internet*

Table 15: Investment projects approved in 2000

Subject	*Recipient*
Production plant for 7-ACA	*BC Biochemie GmbH*
Coating plant based on electrolytic aluminium separation on bulk material	*Aluminal Oberflächentechnik GmbH*
Energy concept for the Wiesloch PZN hospital	*PZN Psychiatrisches Zentrum Nordbaden*
Module brick factory for even bricks	*JUWÖ Porotonwerke Ernst Jungk & Sohn GmbH*
Process for recycling residues from titanium dioxide pigment production	*Sachtleben Chemie GmbH*
Energy-independent heavy engineering factory	*Wasserkraft Volk AG*
Methanization power generation from biomass in Witzendorf	*Shieer Agrar Biorecycling GmbH*
Warendorf bio-power plant	*Bio-Energiewerk Warendorf (BEW) GmbH & Co. KG i.Gr.*
Process for the environmentally compatible coating of aluminium wheel rims	*BBS Kraftfahrzeugtechnik AG*
Exhaust-air cleaning plant with ionisation device in an aluminium production plant	*Gottschol Alucom Aluminium Produktions GmbH*
Solvent-free process for producing technical adhesive strip	*Beiersdorf AG*
Rehabilitation of the sewer network using new water glass injection gels	*Henkel KgaA*
Use and operation of eleven CNG buses	*Stadtverkehr Hildesheim GmbH*
Nanofiltration with concentrate treatment	*Papierfabrik Palm GmbH & Co. KG*

at www.umweltbundesamt.de. The "Leitfaden zur Berücksichtigung der Human Factor Aspekte in verfahrenstechnischen Anlage" [Guideline for considering human-factor aspects in processing plants] (TEXTE 12/01) is also available from Werbung + Vertrieb. *(III 1.2)*

The ZEMA Incident Notification Office

The operators of around 7,800 plants in Germany which are subject to the *Incident Ordinance* reported 41 incidents and safety-relevant occurrences in 1999 (figure 35). Two people were killed, 157 injured as a

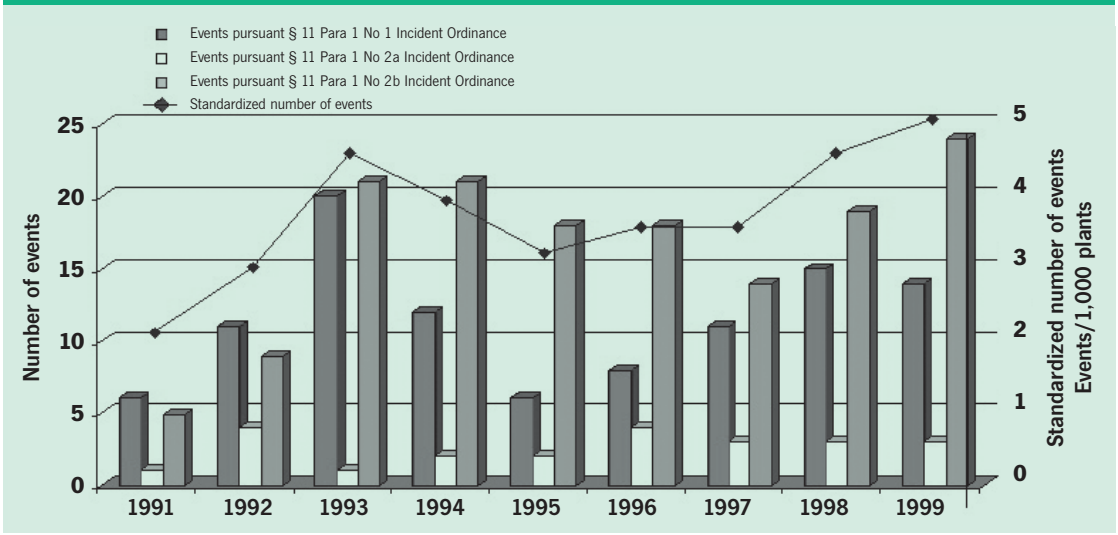
Table 16: Investment projects completed in 2000

Subject	*Company*
ORC plant	*Heidelberger Zement Group Technical Center GmbH, Werk Lengfurt*
Environmentally compatible lead production	*Metaleurop Weser Blei GmbH*
Mohn-druck power plant for cold, heat and power cogeneration and co-operative interlinked energy network	*Mohndruck Graphische Papiere GmbH*
Melting reactor for processing industrial wastes with low tin contents	*Harzer Zink GmbH*
Dismantling night-current storage heaters-containing asbestos	*Wieler + Durian GmbH Umwelttechnik*
More far-reaching sulphate elimination from waste water by means of calcium aluminates in the production of lead accumulators	*Hagen Batterie AG*
More far-reaching sewage cleaning by means of submerged bodies and taking biological phosphorus elimination into consideration	*Wasserver- und Abwasserentsorgungsgesellschaft "Thüringer Holzland" mbH*
Reducing indoor exposure to methyl bromide through the use of an adsorption unit	*Schulz & Berger GmbH*
Use of bio-filters for cleaning solvent-containing exhaust air from the production of intaglio and flexography printing ink	*Druckfarbenfabrik Gebr. Schmidt GmbH*
Processing low-quality to medium-quality used-paper grades as pulp replacement for the production of printing, press and graphic paper	*WEPA Papierfabrik P. Kreusel GmbH & Co. KG*
Fabric filter for dust elimination for a cement clinker kiln	*Alsen AG*

Drafts submitted:

Subject	*Company*
Coating plant based on electrolytic aluminium separation on bulk material	*Aluminal Oberflächentechnik GmbH*
Printing machine based on the computer-to-plate process	*Citydruck GmbH Heidelberg*

Figure 35: Notifications pursuant to the Incident Ordinance



result of these events. The 14 incidents and 27 safety-relevant occurrences reported in 1999 chiefly involved plants in the chemical industry. Around 39 % of the events reported occurred while the plants were operating under normal conditions. Causes were in most cases technical defects in equipment and fittings. The most frequent consequence was a release of hazardous substances, with fire or explosion being less common. The small number of events before 1993 can be explained by the fact that plant owners failed to report all the relevant events during the early days of the notification obligation. *Free copies of the 1999 annual report of the ZEMA Incident Notification Office are available from the Central Answering Service (see box on page 146).* *(III 1.2)*

Reference document for industrial cooling systems

The *EU Directive Concerning Integrated Pollution Prevention and Control (96/61/EU,* refer to page 102) aims at reducing environmentally relevant emissions and the consumption of resources. The underlying rules are laid down as the best available techniques (BATs) for individual industries (pp. 154 and following, page 156) and for the agricultural sector (page 100). They are defined in special documents issued by the European Union, so-called BAT reference documents (BREF).

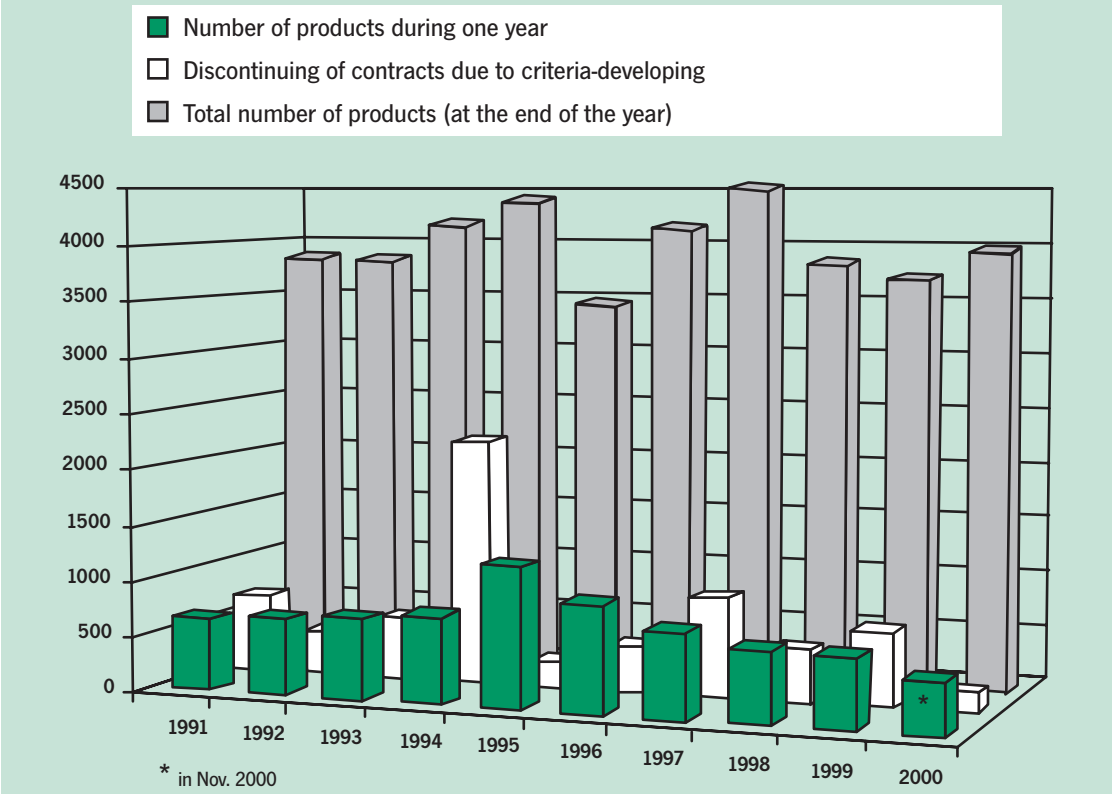
The first multi-industry BREF was completed in November 2000 and deals with BATs for industrial cooling systems which are primarily installed in the chemical, foodstuffs, glass, iron and steel, refinery, pulp and paper industries, as well as in incineration plants and in power stations.

Although the reference document gives an overview of available re-cooling systems, it does not propose any particular technologies or systems for concrete plant types. This is because the specific climatic, meteorological and hydrological conditions prevailing at the site of a plant must be taken into consideration when building and operating a cooling system in addition to the normal legal and technical parameters which are relevant for the selection of a particular system. *The document is available on the Internet at eippcb.jrc.es, as well as from Unit III 1.2 of the UBA (address on page 146).* *(III 1.2)*

The "Blue Angel" eco-label: a dynamic development

The "Blue Angel" eco-label has experienced dynamic development once again in 2000. This is due to the new license agreements entered into and existing agreements terminated each year (refer also to chapter 8). 790 German and foreign suppliers are currently using the "blue angel" for more than 3,900 environment-friendly goods and services. The number of products distinguished by the "blue angel" is thus 469 up against the previous year, a development which corresponds to the long-term trend (figure 36, page 150). This trend is proof that interest in the eco-label among manufacturers and retailers is still high. *(III 1.3)*

Figure 36: Number of products bearing the eco-label



New eco-labels planned

In order to prepare for awarding the "Blue Angel" eco-label to new product groups, feasibility studies are foreseen under the *DIN EN ISO 14024 standard "Type I Environmental Label"*. The aim is to develop a basis for decisions: to what extent does an environmental label make sense for selected product groups, and to what extent is this feasible? The aspects examined to this effect include, for example:

- the selection of suitable product categories,
- consulting with interested parties,
- surveys of markets and suppliers,
- environmental impact of the products,
- potential of and demand for product improvement,
- definition of the scope of validity,
- suitability for use and product quality,
- legal requirements and conventions.

Four feasibility studies were carried out in 2000: for small cogeneration plants, for photovoltaic products and installations (with the Institute for Environmental Economics and Management, IÖW, Heidelberg, being commissioned to perform both studies), for multi-function office machines (Institute for Future Technologies IZT [Institut für Zukunftstechnologie IZT, Berlin]) and for recycling products for the construction industry (Schießl & Raupach, Aachen). Multi-function machines will be discussed here as an example of possible issues. In order to qualify for environmental labelling, it is proposed that candidate equipment offers at least two of the functions "printing", "copying", "facsimile" and "scanning". The criteria include requirements in terms of minimum power consumption, low-noise operation, a recycling-friendly design, avoidance of pollutants, as well as minimum emissions of dust, ozone and organic compounds. *(III 1.3)*

Table-water machines

At its meeting in May 2000, the eco-label jury decided upon the criteria for awarding the "blue angel" to table-water machines. These machines enable consumers to produce sparkling table water from tap water and are considered by the jury as a "reasonable alternative to one-way and returnable systems". The

awarding rules include concrete requirements that must be fulfilled by the machines. One requirement is that the carbon dioxide cartridges for table-water machines be refillable. *(III 1.3)*

Wet-cleaning systems

At its meeting in January 2001, the eco-label jury decided to award the "blue angel" to wet-cleaning systems. Wet cleaning is an environment-friendly alternative to chemical cleaning because it acts without solvents. Nothing but water is used in this gentle cleaning process. The awarding criteria include demanding energy and water consumption requirements. Wet cleaning equipment must meet with certain technical requirements, such as a programmable controller and dosing system for detergent powder. *(III 1.3)*

Global Ecolabelling Network (GEN):

The Global Ecolabelling Network (GEN) was founded in 1994. Its aim is the world-wide exchange of information on all national eco-label activities. Besides the current membership of another 23 nations or national organizations, Germany also joined GEN in order to contribute the experience gained with the German system and to make the criteria developed here known on an international level. This effort is to be coordinated world-wide in order to harmonize the eco-label programmes of the various states, in particular, of those who are currently in the process of establishing an ecolabelling system.

The annual meeting was held in November 2000 in Phuket, Thailand. One aspect which was particularly interesting from Germany's point of view: the "blue angel" as the oldest eco-label (created 1978) has a high repute world-wide. Besides the demanding awarding criteria, it is also considered a special advantage that this label is awarded by an independent board, i.e. the eco-label jury. This is not the case in certain Asian countries, such as Thailand, where a government board is responsible for awarding the eco-label. Several countries have adopted the "blue angel" principles, including Croatia, Taiwan and Indonesia. *(III 1.3)*

How effective is environmental consulting?

Within the scope of a project from the Environmental Research Plan (UFOPLAN), Universität des Saarlandes, chair for social sciences, has evaluated 30 environmental consulting projects from the past ten years. The internal and external effects of subsidised and sponsored consultancy services were assessed within the framework of this study.

The internal project effects which led to changes in the associations and organizations sponsored were evaluated as being very successful. The reason: positions, responsibilities and networks were created for environmental issues. The promotion and subsidy programme has greatly contributed towards the firm establishment of environmental consulting in associations.

Not enough attention was paid to external effects, i.e. diffusion effects which have repercussions for the groups targeted by the associations and the changes they cause there. The lack of verification of external effects is considered to be a shortcoming, also in view of the need to establish a legitimate basis for environmental consultancy in associations.

Five types of associations were identified, depending on their environmental orientation and financial basis:

- Environment-orientated associations with a sound financial basis
- Environment-orientated associations with a poor financial basis
- Associations with a sound financial basis and an environmental institution
- Associations with a sound financial basis without an environmental institution
- Associations with a poor financial basis without an environmental institution.

Different subsidy and promotion strategies are recommended for these types of associations, depending on their specific background. Furthermore, the following recommendations were developed for the environmental consultancy promotion programme:

- Developing a target-orientated project planning approach with a longer-term perspective by introducing a quality system parallel to the project
- Setting up a system of ongoing performance checks with a focus on the groups targeted by the associations
- Shifting the focus of subsidy from structure-orientated measures for setting up and maintaining the current level of environmental consultancy towards measures focusing on target groups

- Developing demand analyses with regard to the acceptance of project targets by and suitability of measures for the target groups. *The final report will be published in the TEXTE series, and will be available from Werbung + Vertrieb (see box on page 146).* *(III 1.3)*

Environmental information for craftspeople

Small and medium-sized crafts firms find it particularly difficult to obtain the necessary information on environmental problems related to their particular trade. In order to support these firms, information brochures were prepared for 21 trades within the scope of a research project. These information leaflets are concise compilations of practical information and hints on the most important issues relevant for environmental protection.

One focal subject of the information brochures is the adaptation of existing and the development of new waste provisions for the different trades. Other topics which are addressed include the protection of waters (handling of water-polluting substances, reducing water consumption, etc.), immission protection, noise protection and energy-saving measures. *Free copies of these information brochures and leaflets are available from the chambers of commerce and trade associations, such as Handwerkskammer Hamburg, ZEWU, Buxtehuder Str. 76, 21073 Hamburg, Germany, telephone: +49 40/3 59 05-834, telefax: -858). They can also be found at the Internet portal for German environmental technology at www.cleaner-production.de*, key word "Industries/Other". *(III 1.1)*

Reducing solvent emissions

The UBA has repeatedly recommended limiting the solvent content in products. These volatile organic compounds (VOCs) contribute towards the generation of harmful summer smog. Reducing VOCs is necessary in order to comply with the future *EU directive on national ceilings for certain air pollutants (NEC guideline)* and the future *EU ozone directive.*

The UBA has commissioned the Hamburg-based Institut für Ökologie und Politik (ÖKOPOL) to examine options for national plans of action. The study describes possibilities for product-related regulations for reducing volatile organic compounds which are generally foreseen in the European treaties and which can be implemented within the scope of immission protection laws. *The study titled "Produktbezogene Maßnahmen zur Umsetzung der EG Lösemittelrichtlinie" [Product-related measures for implementing the EU solvent directive] (TEXTE 9/00) is available from Werbung + Vertrieb (see box on page 146).* *(III 1.4)*

Substitute refrigerant R 22

Chlorodifluoromethane (R 22) belongs to the class of partially halogenated chlorofluorohydrocarbons (H-CFC). It is primarily used as a refrigerant in air conditioning equipment. Since the ban on use and introduction of fully halogenated chlorofluorohydrocarbons (CFCs) in the EU by the *Council regulation 2037/2000/EC on substances that deplete the ozone layer*, R 22 is among the few substances that deplete the ozone layer and the use of which is still permitted in Germany. This is, however, restricted to existing refrigerating and air conditioning equipment where the use of R 22 is permitted until the state of the art enables the use of substitute refrigerants with a lower ozone depleting potential. Such substitute refrigerants must be specified by the UBA. The introduction and use of R 22 and of mixtures containing R 22 in new equipment is now no longer permitted in Germany since 1 January 2000 pursuant to the *Ordinance banning the use of CFCs and halon*.

The Hanover-based research centre "Forschungszentrum für Kältetechnik und Wärmepumpen GmbH" has performed a study in order to determine the current state of upgrading with existing equipment. This study indicates that substitute refrigerants are today available for all applications of R 22. These are to a great extent partially fluorinated hydrocarbons (H-HCs), the toxicological characteristics of which have been sufficiently tested. However, the Kyoto Climate Protocol (refer to chapter 7) has added further requirements for substitute candidates for H-CFCs. *The study titled "Ersatz des Kältemittels R 22 in bestehenden Kälte- und Klimaanlagen" [Replacing the R 22 refrigerant in existing refrigerating and air conditioning equipment] (TEXTE 5/01) is available from Werbung + Vertrieb (see box on page 146).* *(III 1.4)*

Replacing environmentally relevant flame retardants

Treating flammable materials and plastic materials with flame retardants is a common method of fire

prevention. However, findings of toxicologically and ecotoxicologically critical flame retardants and their decomposition products in the environment have given reason for concern.

The UBA has concluded a research project on the "development of evaluation criteria for substituting environmentally relevant flame retardants" to this effect. This exercise was a co-operation project between Öko-Recherche GmbH, Frankfurt/Main, in conjunction with the institute for toxicology at Universität Kiel and the Institute for Socio-Ecological Research (ISOE) GmbH, Frankfurt/Main. The project looked into the present state of the art, as well as trends and alternatives in conjunction with the use of flame retardants in selected products for the construction sector, for electrical engineering and electronics, rail vehicle construction, and the textiles industry.

100,000 tonnes of flame retardants were used in Germany in 1999, with mineral-based systems accounting for around half of this figure, halogenated or antimony-halogen systems for 30 percent, and halogen-free phosphorus and other compounds for 20 percent.

The evaluation of the flame protection systems selected generally indicates that both brominated and phosphorus-organic flame retardants have varying levels of toxicological and ecotoxicological effects, so that some of them must be replaced. At the same time, an application-orientated survey of flame retarding treatments indicates that the use of flame retardants can be reduced in almost all applications. *The study titled "Erarbeitung von Bewertungsgrundlagen zur Substitution umweltrelevanter Flammschutzmittel" [Development of evaluation criteria for substituting environmentally relevant flame retardants] (TEXTE 25/01) is available from Werbung + Vertrieb (see box on page 146).* *(III 1.4)*

Division III 2:

Branches of Industry

Revision of the Technical Instructions on Air Quality Control

The *Technical Instructions on Air Quality Control* from 1986 are in need of revision. This revision will be enacted by the Federal Government pursuant to Section 48 of the Federal Immission Control Act, having heard the circles involved and obtained approval by the Bundesrat as the second chamber of the German parliament. The Technical Instructions on Air Quality Control set forth the requirements under the German immission protection law for installations and plants which must be approved pursuant to the Federal Immission Control Act. These technical instructions contain emission values to be adhered to in order to limit emissions of substances at their place of production. Furthermore, the technical instructions set forth immission values in order to limit immissions affecting man, animals, plants, soil or objects. Both sets of values must be adhered to when plants and installations are built and operated.

The current version of the technical instructions on air quality control must be adapted in many respects to the technical progress and new requirements contained in European law. Besides the *Council directive 96/62 EC on ambient air quality assessment and management* and its *daughter directives*, above all, integrated emission requirements for facilities and plants pursuant to the *EU Directive Concerning Integrated Pollution Prevention and Control (Directive 96/61/EC)* must be adopted.

The huge success of the current version of the technical instructions on air quality control is due to the fact that emission values based on state-of-the-art technology for almost all industrial and commercial facilities and plants requiring approval are set forth in a single set of instructions with a uniform, understandable concept. This is why the revised technical instructions on air quality control will retain the current concept with the following core elements:

- In line with the principle of risk-proportional prevention, emission-limitation requirements are more restrictive for hazardous than for less hazardous substances.
- Emissions of substances with a carcinogenic, mutagenic or toxic to reproduction effect, as well as emissions of organic substances with low decomposition rates, high accumulation rates and a high toxic effect must be minimized under the relevant emission minimizing requirements. These emission minimizing requirements are also the basis for the requirement laid down in the technical instructions on air quality control to substitute particularly hazardous substances.

- Large facilities with high emission mass flows are typically subject to more far-reaching requirements than smaller plants.
- A rehabilitation concept for existing facilities is to be adopted. Pursuant to this concept, existing plants must be upgraded to reflect the latest technical standards within five years after the coming into effect of the revised technical instructions on air quality control.

Other important new features are simplified provisions for plant users and public authorities, in particular, with regard to measuring and evaluation methods and with regard to the implementation of control measurements for the host of organic substances. The UBA has developed the technical and scientific basis for the emission limitation provisions and has proposed concrete proposals for regulations. *(III 2.1)*

European Conference on the Seville Process

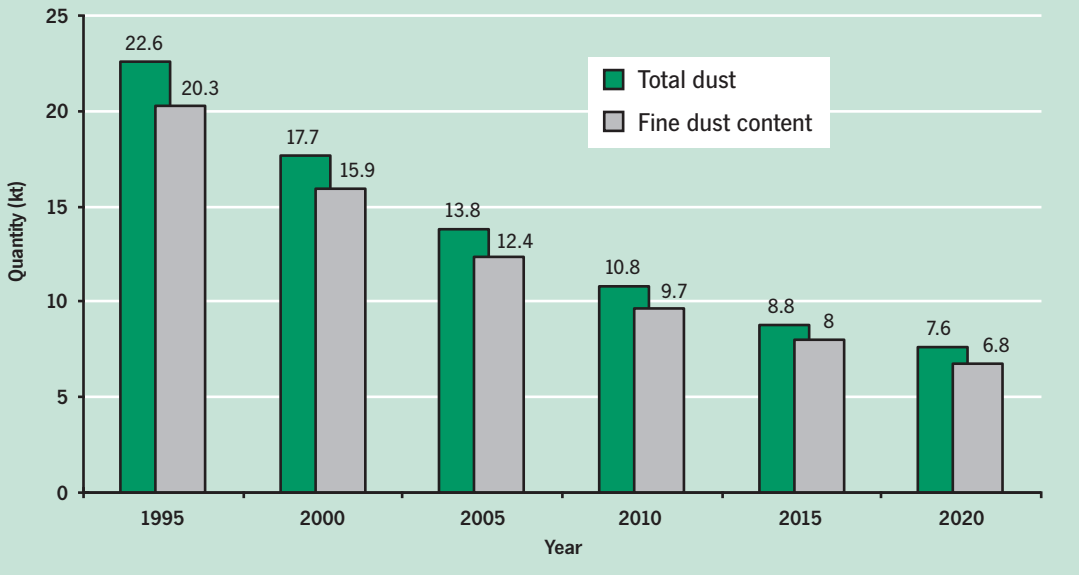
Supported by the Federal Ministry for the Environment (BMU), the European Commission, the Baden-Württemberg Ministry for the Environment and Transport, as well as the Berlin-based company ecologic, the UBA organized the European conference titled "Der Sevilla-Prozess": Motor für Umweltschutz in der Industrie" [The Seville Process: A Driver for Environmental Protection in Industry] in Stuttgart, Germany, in April 2000. Before around 500 delegates from all over Europe, major players involved in the exchange of information pursuant to Article 16 (2) of the *EU Directive Concerning Integrated Pollution Prevention and Control* reported on the progress of their work and the planned use of the BAT reference documents (BREF, refer to page 149) in the different EU member states. *The proceedings titled "The Sevilla Process: A Driver for Environmental Performance in Industry. Conference Proceedings" (TEXTE 16/00) are available from Werbung + Vertrieb (see box on page 146).* *(III 2.1)*

Fine dust emissions from small furnace installations

More recent surveys indicate that respirable fine dust particles (particles with an aerodynamic diameter of less than 10 micrometers, µm) are hazardous to health and capable of causing respiratory disease (refer to page 142). These findings are reflected in the recent resolutions by the European Union on improving ambient air quality. Accordingly, the *1st EU Daughter Directive on Ambient Air Quality (99/30/EU)* also sets forth immission limits for fine dust.

A well-founded data base is necessary in order to successfully implement this directive in national law. This data base is to show how high the particle emissions by the relevant sources are and to what degree these

Figure 37: Development of particle emissions from small furnace installations in households and among small consumers



emissions can be reduced. The department for process engineering and steam boiler design at Stuttgart University was commissioned by the UBA to look into present and future emissions from small furnace installations in household and small consumers. Trends which are so far available indicate that fine dust emissions from small furnace installations will fall by around two thirds by the year 2020 (figure 37). This trend is logical because a declining number of coal-fired and fuel-oil-fired heating systems and the replacement of existing heating systems by new ones can be expected. *The final report titled "Ermittlung der mittleren Emissionsfaktoren ..." [Determining average emission factors ...] (TEXTE 14/00) is available from Werbung + Vertrieb (see box on page 146).* *(III 2.2)*

Reducing dust and dioxins in sintering plants

Iron ore sintering plants can emit larger quantities of hazardous dust, as well as dioxins and furans which are exclusively produced as undesired by-products.

In a research project subsidised under the investment programme for reducing environmental pollution, a particularly effective fibrous filter was retrofitted at the downstream end of the existing electrostatic filter of the Stahlwerke Bremen steelworks. This was the first installation where dust emissions were safely reduced to less than ten milligrammes per cubic metre (mg/m^3) in continuous operation. At the same time, toxic heavy metals – such as lead, cadmium and thallium – are effectively eliminated. Additions of lime hydrate and open-hearth coke lead to drastically reduced dioxin and furan emissions. Dioxin and furan concentrations of less than 0.1 nanogramme per cubic metre (ng/m^3) in the cleaned gas were achieved in initial trials. *The final report titled "Maßnahmen zur Verbesserung der Entstaubung einer Eisenerzsinteranlage mit nachfolgenden Untersuchungen zur Minderung der PCDD/PCDF-Emissionen" [Measures for reducing the dust separation effect of an iron ore sintering plant followed by studies on the reduction of PCDD/PCDF emissions] is available on loan under number 1123 from the UBA's library (address: page 146).* *(III 2.2)*

"Suction pipe" with weaknesses

In spring 2000, the German Conference of the Ministers of the Environment (UMK) called upon the Federal government to amend the *ordinance on limiting hydrocarbon emissions during motor vehicle refuelling processes (21st Federal Immission Control Act)* by introducing more restrictive requirements. Control measurements performed by the Federal States had shown that up to 30 % of the gas return systems ("suction pipes") had completely failed. This led to increased emissions of hazardous petrol fumes and hence increased ozone exposure. The UBA has developed technical proposals for the revision process. On 15 November 2000, the parties involved were heard on the revision ordinance on the *21st Federal Immission Control Act*. Most of the changes aimed at improved the monitoring of "suction pipes". Future requirements include, for instance:

- a need to install automatic monitoring systems for suction pipes,
- a requirement to switch off the petrol pumps in cases of extended malfunction,
- improved monitoring by specialist contractors and petrol stations.

The revision ordinance on the *21st Federal Immission Control Act* is expected to come into effect in summer 2001. The main purpose of this effort is to reduce ground-level ozone concentrations. *(III 2.3)*

Integrated environmental protection in mineral-oil refineries

In order to implement the *EU Directive Concerning Integrated Pollution Prevention and Control (96/61/EU)*, work is underway on a reference document describing the best available techniques (BATs) for reducing emissions in the mineral-oil industry. The firm R+D Ingenieurleistungen, Uslar, Germany, was commissioned by the UBA to prepare the technical basis as the German contribution for the corresponding BAT reference document (BREF, refer to page 149). This study describes the extent to which selected German refineries have already succeeded in reducing emissions. *The final report in German and English is available on loan under number 000043 from the UBA's library.* *(III 2.3)*

Life cycle assessment in waste oil recycling

In Germany, some 500,000 tonnes (t) of waste oil are collected each year. Around 65 % of this is reprocessed to base material for new lubricants, fuel oils, flux oils (aggregate for bitumen). Around 34 % is

used by the cement industry as a substitute for coal dust or heavy fuel oil. Under the *Waste Avoidance, Recycling and Disposal Act (KrW-/AbfG)* of 27 September 1994, the Federal Government is empowered to give priority to the more environmental-friendly form of recycling.

The firm Arcadis Trischler und Partner, Darmstadt, and the IFEU Institute, Heidelberg, were commissioned by the UBA to evaluate four recycling routes on the basis of life cycle assessment: recycling to base oil, fuel oil and methanol, as well as utilisation of the energy content in cement mills.

The life cycle assessment data was subsequently evaluated by the UBA itself using a method developed for all life cycle assessments by the Agency. The evaluation did not indicate a clear ranking of the methods because each process has its advantages over the other processes in at least one action parameter. *The survey titled "Ökologische Bilanzierung von Altöl-Verwertung" [Ecological assessment of waste oil recycling] (TEXTE 20/00) is available from Werbung + Vertrieb (see box on page 146).* *(III 2.3)*

Emission reductions in the pharmaceutical and speciality-chemicals industries

The *EU Directive Concerning Integrated Pollution Prevention and Control (96/91/EU),* which has already been referred to several times, requires an integrated evaluation of emission paths when it comes to approving industrial plants under this directive. A research project carried out by the institute for environmental technology and management of Witten/Herdecke University on behalf of the UBA, addressed the task of developing a basis for implementing this requirement in practical administrative and legal approval procedures. The authors examined the interactions between additional waste water and exhaust air treatment processes, recycling of materials with the intention to use their energy contents, and modifications of production processes in various sectors of the pharmaceutical and speciality-chemicals industries, and they further examined how all these measures can contribute towards improved environmental protection. *The final report titled "Möglichkeiten medienübergreifender Emissionsminderungen am Beispiel von Betrieben der Pharma- und Spezialitätenchemie" [Ways of pan-media emission reductions by the examples of facilities of the pharmaceutical and speciality-chemicals industries] will be published in the TEXTE series, and will be available from Werbung und Vertrieb (see box on page 146).* *(III 2.3)*

Europe-wide plant-related environmental protection

The European IPPC office (IPPC = Integrated Pollution Prevention and Control) in Seville, Spain, is the leading institute for the development of the BAT reference documents (BREF, refer to page 149). As a "national focal point", the UBA is actively involved as the German representative in the exchange of information. Together with Federal State governments and industry, data on the current state of the art in Germany was gathered and processed, and proposals for the contents of BREFs were developed.

In 2000, the first eight BREFs were completed for the following sectors of industry:

- iron and steelmaking industry,
- cement and lime industry,
- paper and pulp production,
- nonferrous metals industry,
- glass industry,
- metal-processing industry,
- chlor-alkali industry,

as well as the re-cooling systems mentioned on page 149 as a BREF not restricted to a particular industry. Drafts were submitted for the sectors of intensive husbandry, tanneries, organic base chemicals, refineries (refer to pp. 100 and 155), waste water and exhaust air treatment in the chemical industry, as well as for the cross-section BREF "Monitoring of emissions". *An up-to-date overview of the status of work is available on the Internet at eippcb.jrc.es where the finalized BREFs and drafts can also be found.* *(III 2.1)*

EU solvents guideline in Latvia

At the request of the Latvian Ministry for the Environment, a co-operation project between a Latvian and a German consultancy on the implementation of the *Council Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents* is being sponsored within the scope of the consultancy aid programme. The aim of the directive is to reduce transboundary VOC emissions which contribute towards the formation of

ground-level ozone. The Riga-based Latvian consultancy, Elle, will be able to benefit from the experience of the Hamburg-based German partner, ÖKOPOL, whilst the German counterpart will be able to learn to understand the procedures of the Baltic state. The project includes several workshops in Riga with participation from environmental authorities, monitoring institutions, statistical offices and representatives from industry. *(III 2.4, I 1.2)*

Database on packaging material use and production in Romania and Bulgaria

Germany is a partner of the EU candidate countries Bulgaria and Romania within the scope of twinning projects (refer to chapter 1) in the field of waste management. One important part of these projects is to transpose the *EU Directive on Packaging and Packaging Waste* to national law and to practically implement this directive. The packaging regulations of the different countries have a major influence on waste management on a national level and on the economy as a whole. Due to the political and economic history of the past ten years, reliable data on packaging and packaging waste is, however, not available for any of these two countries.

Germany has hence offered to generate the necessary data within the framework of bilateral projects funded by Germany. On the basis of national statistics, written and oral polls among industrial, trade and regional public representatives, statistical data is to be gathered and evaluated with regard to packaging production and products, imports and exports of packaging materials, the structure of the packaging industry, the number of companies affected and their size, as well as quantities and composition of municipal waste. Volume flow models and prioritary material flows are to be developed on this basis. A methodological approach to the packaging issue is to be developed and discussed with the parties concerned.

Another, however, problematic step will be the methods for estimating current packaging consumption. The overall concept must be discussed with the circles involved and its suitability for practical application tested. Intermediate and final results will be compared and analysed at two workshops. These workshops play a particularly important role, not just because they represent bilateral activities of Germany on the one hand and Romania and Bulgaria on the other, but also because they are triggering co-operation between Romania and Bulgaria in the field of waste management. *(III 2.4, III 2.5)*

Twinning project on waste management in Romania: a field report

Within the scope of a twinning project awarded to Germany and launched in November 1999, European waste law is to be transposed to Romania. One long-term expert from the Federal State of Brandenburg and three short-term experts from the Federal States of Lower Saxony and Berlin, as well as from the UBA are assisting in analysing the national waste management strategy, in transposing European waste law and all the relevant guidelines to Romanian law, in identifying ways for funding waste management and in developing models for co-operation with industry and regional environmental authorities. Waste management databases and a foundation for the necessary public information work are to be developed to this effect.

The project gives the German experts the possibility to pass on their expertise to countries with difficult boundary conditions. On the other hand, they can gather experience for their own work in Germany.

The experts were faced with extremely difficult underlying conditions in Romania and its Ministry for the Environment. Human resources are scarce in the ministry, there is no independent department in charge of waste, and staff are poorly paid. Seven ministries are responsible for waste issues. The country's waste disposal system is at a very low technical level, recycling programmes collapsed following the political turn. The national income continues to decline, funding of waste management programmes through charges is currently only possible, if at all, with enormous difficulty.

Despite these shortcomings, inter-ministerial working groups have been set up, and intensive dialogue was started between various Romanian partners and the German experts, with first drafts for Romanian regulations already developed for almost all waste-relevant EU directives. Although this process is quite often hindered by the difficulties already mentioned, it is successful against all expectations. The major problems facing all the measures are related to fundamental decisions on planning, approving, implementing and

– above all – funding waste management. First steps in the necessary dialogue between all the partners, including municipalities, business and industry, the general public and non-governmental organizations (NGOs), have already been made, but this effort must be substantially strengthened. *(III 2.4)*

Support of the "waste management and rehabilitation of contaminated sites" project: a summary

As a supporting unit on behalf of the Federal Ministry for Education and Research (BMBF), the UBA has been responsible for the research issue of "waste management and rehabilitation of contaminated sites" since 1976. The aim was to support the ministry in the preparation and implementation of environmentally relevant support and subsidy programmes. This task included the design and development of subsidy and promotion initiatives, as well as their preparation, technical support and evaluation. As the project support unit, the UBA was also responsible for the dissemination of its research results in publications, meetings, status seminars and papers.

During the 25 years of its existence, the close integration of the project staff into the UBA has always ensured that the results of the research projects were immediately transferred to the practical level in companies, public authorities and education institutions, so that a direct effect on the development of environmental standards and codes was achieved.

In 2000 alone, 188 proposed projects were examined, 35 projects to be approved were handled and more than 140 ongoing projects were supported. Eight status seminars and three technical meetings and workshops were organised. Seven final reports were selected and published in the "green-white series" of the Federal Ministry for Education and Research (BMBF).

The focus of work at the BMBF has shifted, with the support unit being gradually dissolved by the end of the year 2001, thereby ending 25 years of successful project support work.

One important issue in 2000 was to prepare for mid-2001 a smooth transition of the support and subsidy measures, as well as the projects designed by the project support unit at the UBA to other supporting units working on environmental research at the BMFT. The names of these project support units are reported in conjunction with the tasks of the year 2000 described in the following. *The information is also published at the time of the dissolution of the project support unit on the Internet at www.umwelt-bundesamt.de.* *(III 2.6)*

"Porous bitumen" joint research project: The four sub-projects of the joint research project on "a process for environment-compatible road rehabilitation by cold recycling with porous bitumen" launched in July 2000 are the last part of a major joint research effort titled "recycling of waste materials in road construction" which comprises eight separate projects. The aim of the joint effort is the practical implementation of the cold recycling process with porous bitumen for road rehabilitation. Three companies and one university institute are working on separate focal issues: The Windhagen-based company Wirtgen is preparing the design and trial operation of a machine prototype and has modified and adapted conventional equipment for this purpose. The processes during mixing, pollutant emissions, behaviour of residual matter, as well as aspects of closed-loop recycling are being examined. The Aachen-based Gesellschaft für Automatisierung, Prozesssteuerung und Schweißtechnik APS is addressing aspects related to computerized process control. The final user of the recycled material is the Hornhausen-based company Schmitt which is evaluating the material and processing properties of the recycled material in co-operation with the institute for road and railway construction at Bochum university. The joint research project is to be concluded by mid-2003 with practical trials of the complete equipment resulting from this effort. The project partner "biology, energy and ecology" at Forschungszentrum Jülich (FZJ/PT BEO) was commissioned by the UBA with the complete joint project. *(III 2.6)*

Possibilities and limits of new use strategies – regional approaches: Within the scope of the "Sustainable management" research focus, the project partner has drafted the "Use intensification, part A: regional approaches" project and called for tenders for this project. In two expert rounds, 12 research projects were selected from the 63 drafts. These 12 projects qualified for applications for studies into the question of to what extent the creation of regional networks can initiate and permanently establish more sustainable product uses by repairing, upgrading, replacing through services, shared uses and similar approaches, and to what extent this can also be applied

to the development of new use strategies through communication, Organization and information. These projects are based on an inter-disciplinary research approach, i.e. scientists from various fields co-operate with the most diverse partners. The process-orientated research projects are to be accompanied and evaluated by intensive supporting research.

The project partner "environment and climate research" at Forschungszentrum Umwelt und Gesundheit (GSF/PT UKF) is to implement this project on behalf of the UBA. *(III 2.6)*

Technology register on the rehabilitation of contaminated sites: The new TERESA 2.1 database system was developed by the Aachen-based company FOCON GmbH. The database is now available as a reference instrument for land owners, companies, experts and public authorities, as well as the interested public. The database system on CD-ROM documents the high technical standard achieved in Germany in the rehabilitation of contaminated sites and enables effective evaluation. The system can be amended and meets with the requirements of state-of-the-art information management. The database is based on a special questionnaire which reflects the defined minimum requirements for a characterisation of the rehabilitation methods. This questionnaire was developed in co-operation with industry and public authorities. The database currently offers an overview of 116 rehabilitation companies, it describes 189 rehabilitation methods and contains 680 references for the rehabilitation of contaminated sites. *Free copies of the CD-ROM TERESA 2.1 are available from Init I 1.1 at the UBA (address: page 146).* *(III 2.6)*

Cleaning walls for the rehabilitation of contaminated sites: Cleaning walls consist of barrier systems extending down into the groundwater horizon, with permeable gates in the wall systems containing reactants for bonding pollutants.

The aim of the integrated project is to demonstrate possible applications and limits, as well as the effectiveness of cleaning walls, in particular, with a view to reducing the costs of rehabilitating contaminated sites.

The "water technology" project partner at Forschungszentrum Karlsruhe (FKZ/PT WT) was commissioned by the UBA with the joint research project. *(III 2.6)*

Natural retention and degradation of pollutants: As a result of the joint project on the "controlled natural retention and degradation of pollutants during the rehabilitation of contaminated soils and groundwaters", 184 project drafts were received and evaluated, with 46 proposed projects qualifying for project applications. The aim is the examination, evaluation and targeted use of the natural decomposition and retention processes in the ground, as well as the development of the appropriate evaluation methods needed. The surveys necessary for this purpose are to be carried out for industry-specific pollutants on 40 thoroughly explored contaminated sites typical for Germany.

The "water technology" project partner at Forschungszentrum Karlsruhe (FKZ/PT WT) will be in charge of the support and subsidy programme. *(III 2.6)*

Research into preventive soil protection and sustainable soil use: In co-ordination with the Federal Ministry of Education and Research (BMBF), the topic of "soil research for the purpose of preventive soil protection and sustainable soil use" was prepared as a focal research issue in order to develop the foundation for more sustainable use of soil as a resource, at least in the medium term, and in order to develop exemplary implementation approaches to this end both for Germany and for regions with different climatic, social, structural and economic conditions.

Although the new soil protection research is to carry on the former research into contaminated sites and landfills which was so far sponsored and subsidized by the Federal Ministry of Education and Research (BMBF) and which inevitably had to respond to topical problems and which mainly focused on the retention of undesired organic and inorganic pollutants in the soil, as well as their elimination, the new soil protection research approach is to play an active and preventive role in protecting and permanently improving soil functions. The influences of social and economic conditions (regional planning, land use, land recycling) are also to be addressed in this context. *Further information is available on the Internet at www.kompetenznetz.de*.

The focal issue "sustainable soil use" is based on the present differentiation of existing technical and administrative tools in soil and planning legislation. This

exercise aims at creating a scientifically founded basis for the further development of these tools.

The focal research issue is to be managed by the project partner "biology, energy and ecology" at Forschungszentrum Jülich (FZJ/PT BEO) in future. *(III 2.6)*

Exploration of the underground of landfill and abandoned dump sites in Thailand: This integrated project launched in 2000 aims to ensure clean ground and surface waters for drinking-water production in Thailand on a lasting basis. Recommendations for ecologically effective and economically reasonable methods are to contribute towards reducing costs for environmental protection related to landfills and abandoned dump sites.

Six German companies are working on adapting German expertise to the conditions prevailing in Thailand. Local specialists are being trained and an important basis is being created for future co-operation and multi-national environmental standards.

The Federal Institute for Geosciences and Natural Resources (BGR) is in charge of project co-ordination and organises co-operation among the German partners themselves and between these and the Thai partners. The German partners are examining to what extent the German multi-barrier principle can be applied to drinking-water treatment (refer to chapter 9) in Thailand.

The "water technology" project partner at Forschungszentrum Karlsruhe (FKZ/PT WT) will be commissioned by the UBA with the support and subsidy programme. *(III 2.6, III 2.4)*

German/American research co-operation in land management: For ten years, the Federal Ministry of Education and Research (BMBF), represented by the project partner in the UBA, and the United States Environmental Protection Agency (US EPA) have been co-operating in the field of rehabilitation of contaminated sites. Phases I and II (1989 to 2000) of the bilateral co-operation project first surveyed innovative technologies for rehabilitating contaminated sites on the basis of the partner country's standards. Drawing on these results, the working group of Probiotec/FOCON GmbH, Düren/Aachen, together with German companies developed recommendations for a German technical standard for contaminated sites – decontamination (DETAD) and for monitoring rehabilitated, formerly contaminated sites (DEMAS). *The results of the project that was concluded in 2000 are available free of charge as a CD-ROM from Unit III 2.6 at the UBA (address: page 146). The CD also contains all the test schedules and test reports of phase II.*

The Federal Ministry of Education and Research (BMBF) and the US EPA are determined to continue this successful co-operation. Preparation work is already underway on Phase III and will address the more complex issue of land management and land recycling.

The concept developed by the project partner to this effect is orientated towards the requirements of sustainable settlement development. It aims at a joint research project on the development of strategies for the increased use of fallow sites and hence for the reduced use of land, as well as for more active rehabilitation of contaminated sites.

The concept is rounded off for the purposes of bilateral co-operation by two feasibility studies by the Düren-based company Probiotec GmbH and the German Institute of Urban Affairs (Difu), Berlin, and at the same time also forms the basis for a national research focus on "sustainable land management".

The focal research project and the bilateral research co-operation will be transferred by the UBA to the project partner "environment and climate research" at the GSF (PT UKF/GSF). *(III 2.6)*

Division III 3:

Waste and waste water management

Transboundary movements of waste

The Federal Environmental Agency (UBA) is responsible for approving shipments of hazardous wastes through Germany. 226 applications were processed of which 225 were approved in 2000. Objections were raised against one application. The UBA's approvals also contain restrictions and information concerning special procedures to be adopted in Germany.

Transit waste shipments through Germany have grown considerably compared to previous years (fig-

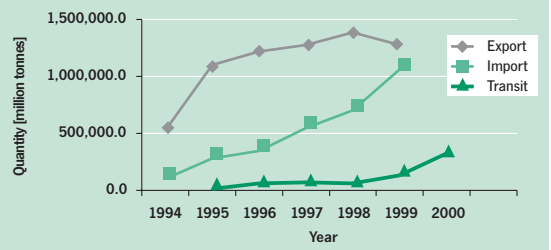
ure 38). Shipments totalled some 330,000 tonnes (t) in 2000. This is because very large quantities of treated wood were shipped from the Netherlands (230,000 tonnes) and Belgium (43,000 tonnes) to Italy in 2000.

45 Federal State agencies share the responsibility for approving exports and imports which causes delays in data gathering. This is why only the 1999 figures are available so far.

Waste imports requiring approval have increased from year to year since the *Council regulation on the supervision and control of shipments of waste* came into effect. Waste imports in 1999 totalled 1,060,000 tonnes. According to the underlying applications and approvals, most imports were metal wastes classified as hazardous, i.e. primarily dusts and slurry (210,000 tonnes), waste incineration residues (160,000 tonnes), liquid manure (84,000 tonnes), solvents (45,000 tonnes), contaminated soil (63,000 tonnes), treated wood (55,000 tonnes) and sewage sludge (33,000 tonnes). The Netherlands accounted for most of these imports (410,000 tonnes), followed by Belgium, Switzerland, Luxembourg and Austria with 100,000 tonnes each. Imports from non-European countries were very low totalling less than 3,000 tonnes.

Exports of wastes requiring approval are currently stagnating. The volume totalled 1,277,000 tonnes in 1999. Substances accounting for the largest part were treated wood (521,000 tonnes), metal-containing wastes with a dispersion risk (140,000 tonnes), gypsum waste from flue gas desulphurisation (78,000 tonnes) and contaminated soil (73,000 tonnes). Main importers were Italy (390,000 tonnes) and France (230,000 tonnes), followed by Sweden, the Netherlands and Belgium with 100,000 tonnes each. Exports of hazardous wastes to developing countries are forbidden. Exports to non-European industrialised countries totalled just 3,000 tonnes and hence correspond to the low import levels from these nations. Approval procedures also covered 140,000 tonnes which were classified as non-hazardous under EU law (primarily waste glass, used paper and old textiles) and which were exported to various eastern European countries.

Figure 38: Transboundary movements of wastes since the EU-wide implementation of the Basle Convention



Only a small number of irregularities liable for reporting were recorded in 1999, including two accidents involving a waste volume of less than 20 tonnes, as well as eight shipments which had to be stopped – despite previous approval – due to unforeseen difficulties (so-called failed shipments). Illegal imports, exports and trans-shipments of waste have been classified as punishable offences pursuant to Section 326 *of the German Penal Code (StGB). Detailed statistics can be found in the "Bericht zur grenzüberschreitenden Abfallverbringung" [Report on transboundary waste shipments] which will be published in the TEXTE series and available at Werbung + Vertrieb (address: page 146). Detailed information on approval application procedures, including the latest legal provisions, is to be found in the "Praxishandbuch zur grenzüberschreitenden Abfallverbringung" [Practical hand-book on transboundary waste shipments], Erich Schmidt Verlag, Berlin, 2000, ISBN 3-503-05957-1 (available at bookstores).* *(III 3.1)*

Stock-taking of appliances containing PCB

Council Directive 96/59/EC on the disposal of polychlorinated biphenyls (PCBs) and polychlorinated terphenyls (PCTs) – in part implemented by the *PCB/PCT-waste ordinance* of 26 June 2000 – requires a stock-taking of all appliances which contain more than five litres of PCBs. Furthermore, operation of appliances containing PCB has been subject to exceptional approval under the *Ordinance on hazardous substances* since 1 January 2000. With a view to the obligation to report to the European Union, the UBA first had the total volume of PCBs yet to be disposed of as per the end of 1999 determined by a research project. In another step, the UBA and the environmental ministries of the Federal States surveyed the exceptional approvals for continued operation of appliances containing PCB, as well as the quantities of PCB-containing appliances and liquids as per 31 December 2000. It was found that by far

the largest part of appliances subject to the ban on operation has been taken out of operation and disposed of in the meantime. The residual quantities yet to be disposed of can be easily handled by existing disposal capacities. *(III 3.2)*

Disposal of animal meal and fats

In view of the first BSE (bovine spongiform encephalopathy, "mad-cow disease") case which occurred in Schleswig-Holstein in November 2000, the *Law banning the feeding, intra-community shipment and export of certain animal foods* was enacted on 1 December 2000 and came into effect the same day. The recycling of animal cadavers to produce animal food and the feeding of such food to livestock has been stopped since. New alternative ways of disposing of cadavers had to be found for disposing of animal foods and their precursor stages. Animal meal and fats can be used as fuel because of their high caloric value, so that their use in incineration plants is possible. This can be waste incineration plants, cement mills, coal-fired power stations, sewage sludge incineration plants, as well as large-scale gasification plants. A research project was launched at short notice at the end of the year in order to develop an overview of the current knowledge related to the incineration or co-incineration of animal meal and to develop recommendations within the shortest time possible. *The "Leitfaden zur Tiermehl-/Tierfettverbrennung" [Guideline on animal meal/fat incineration], including lists of suitable facilities and a classification of animal meals and fats has been available on the Internet at www.umweltbundesamt.de and www.bmu.de since February 2001. (III 3.3)*

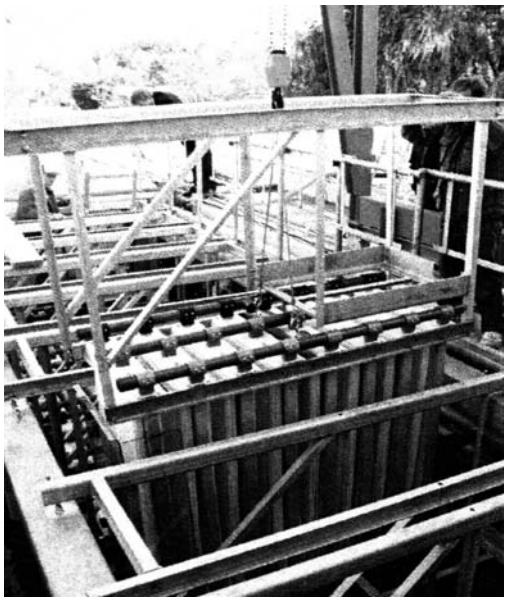
Biological tests for assessing the hazard to waters caused by wastes

The *Federal Water Act (WHG)* includes a definition of the term "substance hazardous to waters" within the scope of the purpose of this act to protect waters against pollution from technical plants. The classification of substances and mixtures in water hazard classes is the subject matter of the *General Administrative Regulation on the Classification of Substances Hazardous to Waters into Hazard Classes* on the basis of European legislation on hazardous substances. A research project carried out by the UBA itself was aimed at first determining the water hazard properties of undefined and heterogeneous multi-substance mixtures by the example of waste, and at subsequently developing a classification model for water hazard classes on this basis.

Six waste samples – two sewage sludges, one fly ash, foundry granulates, electroplating and paint residues – were selected. The analyses were based on simple and multiple elutions with water at different pH values ("neutral" and "acid" elution). The eluates were subjected to different aquatic biotests, including the acute daphnia test according to the DIN 38412 part 30 standard, the luminescent-bacteria inhibition test (DIN 38412–L 34/L 341) and the *pseudomonas* cell multiplication inhibition test (DIN 38412 part 8). Furthermore, the eluates were also physically and chemically characterised. According to an evaluation proposal which has yet to be finally discussed with the Commission for the evaluation of substances hazardous to water, the water samples analysed must be classified as hazardous to waters within the scope of Sections 19 g and following of the Federal Water Act. *(III 3.6)*

Saxon sewage plant sets standards with biomembrane technology

Membrane technology is particularly useful for the treatment of municipal waste water. Its advantage: it eliminates practically all pathogens and antibiotic-resistant microorganisms from the treated waste water (1996 and 1997 annual reports). The selection



Installation of a membrane filter package at the Markranstädt sewage treatment plant. (Photo: UBA)

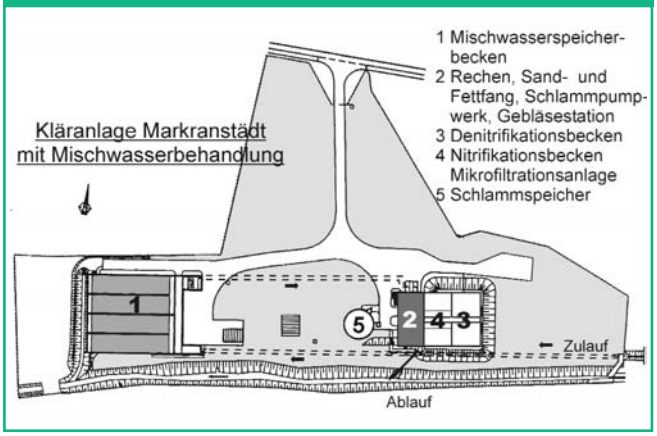
of sufficiently small pores in a membrane ensures that only cleaned waste water, but no microorganisms or other particles can pass the filters. Waters – in particular, bathing waters – are no longer contaminated by pathogens, faecal microbes and other waste-water bacteria – a sensible approach to disease prevention.

A sewage treatment plant goes even beyond this if the membrane filters are submerged directly into the activated sludge of the biological treatment stage, so that the cleaned waste water is filtered directly from the biomass. It is thus no longer necessary to try to separate the **ACTIVATED SLUDGE** from the cleaned waste water in secondary settlers which are otherwise common practice even though they do not produce perfect results. The waste-water bacteria count can be multiplied without any risk of scouring losses. This means substantially better and safer cleaning of waste water.

Kommunale Wasserwerke Leipzig GmbH, which treats the waste water of the neighbouring municipality of Markranstädt, has designed the new Markranstädt sewage treatment plant along the process principles outlined above. The sewage treatment plant with a capacity designed for 12,000 people was officially opened on 1 September 2000. Both trial operation before opening and ongoing practical operation have confirmed that the biomembrane technology of this plant is setting new standards for the cleaning of municipal waste water. The filtered waste water is practically free from turbidity and germs. The "chemical oxygen demand" parameter shows the improved cleaning performance in conjunction with the decomposition of organic pollutants: rather than 75 milligrammes per litre (mg/l) as the lowest limit value for this parameter in the *Waste water ordinance*, this value amounts to between 21 and a maximum of 26 mg/l with the new plant. This means that the residual organic pollution of the cleaned waste water is only slightly above the lower

Activated sludge: *The sum of all the microorganisms occurring in the biological treatment stage, a small part of which is imported with the raw water and the larger part of which grows there (biomass). By decomposing the greatest part of the organic matter in waste water, waste-water bacteria eliminates pollutants from the waste water, thus cleaning it.*

Figure 39: Site map (land use) of the Markranstädt sewage treatment plant



Another advantage is that the plant saves land and treatment volume. The site would have been too small for a new plant based on conventional principles. Thanks to the biomembrane technology, it was even possible to additionally accommodate the rainwater/mixed-water treatment unit. Figure 39 is a site map of the plant. *(III 3.5)*

Biological phosphorus elimination in Blankenburg (Harz region)

The new construction of the Blankenburg sewage treatment plant was to ensure, within a short time, a far-reaching cleaning of the waste water for the city of Blankenburg and its neighbouring municipalities in the nature reservation areas of the Harz regions and the lowlands to the north. The following treatment stages were planned for the sewage treatment plant:

- upstream biological phopshorus elimination ("bio-P elimination"),
- deliberate nitrification and intermittend denitrification,
- downstream microscreen filtering plant,
- clearing basin.

Furthermore, two rainwater overflow basins were to be built.

Within the scope of the investment programme for reducing environmental burdens by water quality control, the project was sponsored by the Federal Ministry for the Environment in co-operation with the UBA granting an interest allowance of around EUR 2.5 million. The combination of the processes was to improve process stability and enable biological phos-

phorus elimination with fewer precipitants and less sludge.

The aim was achieved. It was even possible to omit the construction of the microscreening plant, so that the investment was even EUR 410,000 below budget. The Blankenburg sewage treatment plant is an important contribution towards improving water quality. It thus fulfils the aim of reducing immissions from municipal sources into waters in line with the "sustainable water management" plan of action which was developed within the scope of the Environmental Research Plan (UFOPLAN) of the Fraunhofer Institute for Systems and Innovation Research, Karlsruhe, Kassel university and the Göttingen-based Büro für Ökologie und Planung. *The final report titled "Biologische P-Elimination, Nitrifikation und intermittierende Denitrifikation auf dem Gruppenklärwerk Blankenburg" [Biological P elimination, nitrification and intermittent denitrification in the multi-municipality Blankenburg sewage treatment plant] is soon to be published in the TEXTE series and will be available from Werbung + Vertrieb (see box on page 146).*
(III 3.4)

Plant-covered permeable barriers

Plant-covered permeable barriers are well-studied with regard to the parameters of waste water which are subject to monitoring and waste-water charges, as well as with regard to a reduction of nutrient contents. These long-term surveys confirm the general suitability of certain types of plants for cleaning domestic waste water. There are, however, only a few studies that assess the performance of such plants in eliminating pathogens from waste water. It is hence not possible to generally assess the epidemiological risk. Such surveys are indispensable from the point of view of disease prevention because construction and operation of plant-covered permeable barriers have strongly increased and because the water is discharged into waters which are ecologically delicate and susceptible to environmental burdens, such as upper courses of brooks, standing waters, including reservoir waters and bathing waters, or because the water is leached into the soil and groundwater.

Various department units of the UBA are working on a project sponsored by the German Federal Foundation for the Environment in which the concentrations of indicator organisms (such as *escherichia coli*, enterococcus, coliphages) and pathogens (such as salmonella, *campylobacter*, cryptosporidies, giardia) are determined in multi-stage treatment plants which chiefly treat domestic waste water.

The surveys so far suggest that the elimination performance of plant-covered permeable barriers with regard to indicator organisms and pathogens is clearly superior to that of conventional biological waste water treatment plants.

With regard to the indicator organisms, the elimination rates reach a level of three to four to the power of ten for multi-stage vertical and horizontal permeable barriers. In the case of pathogens, the trend is fairly the same for the respective treatment stages. *Campylobacter*, for example, is reduced by four to the power of ten by the permeable barrier system. Salmonella, cryptosporides and giardia are no longer found in the water discharged from permeable barriers.

Conclusion: State-of-the-art, plant-covered permeable barriers are today a technically equivalent alternative to central conventional waste water treatment.
(III 3.5, II 2.4, II 4.6)

The alternative to the animal test: the roe test

After three years of development and standardisation with participation by Federal State governments, industry and universities, the DIN 38415-T6 standard for the determination of non acutely toxic effect of waste water on the development of roe via dilution stages (refer to the 1999 UBA annual report) has been completed. It is thus possible to replace the acute fish test which is currently still required pursuant to the *Waste Water Ordinance (AbwV)* and the *Waste Water Charges Act (AbwAG)*.

The evaluation of the ring test required within the framework of the standardisation procedure with the involvement of Federal State governments and industry provided very good results both for repeatability and for comparability between laboratories. The roe test is not subject to animal protection legislation. Most Federal State governments are likely to apply the test as soon as possible once the standard is in effect. Industry has already gone great lengths to introduce the roe test in lieu of the acute fish test in the future. *(III 3.6)*

Elimination of pharmaceuticals from waste water

Trace substances with a functional action – such as active principles of pharmaceuticals, substances affecting the hormone balance – when discharged from sewage treatment plants enter surface waters and thus reach the bank filtrate which is used for winning drinking water and for artificial groundwater recharge. In order to avoid undesired effects on human and animal metabolism, measures must be taken in order to prevent these substances from entering the drinking-water cycle by eliminating them as early as in the waste water treatment plants.

The drugs phenazon, diclophenac and ibuprofen, as well as bezafibrate and clofibrinic acid were hence subjected to a comparative study of their elimination behaviour in concentrations from 1 to 5 microgrammes per litre (µg/l) in a conventional laboratory waste water treatment plant and in the membrane-supported activation process (see above).

In the case of ibuprofen, both plants enabled an elimination rate of 95 %. In contrast to this, elimination of diclophenac in the biological process was not as good. A 57 % elimination rate was achieved in the conventional laboratory sewage treatment plant, whilst the biomembrane filtering plant achieved a rate of close to 70 %. The phenazon (antipyrine) elimination rate totalled 92 % in the conventional laboratory waste water treatment plant and was hence eliminated more intensively from the aqueous phase than in the biomembrane plant (elimination rate of 75 %). On the other hand, bezafibrate was completely eliminated by the biomembrane filter system, whilst the conventional laboratory waste water treatment plant eliminated only 79 % of the bezafibrate from the aqueous phase. The elimination rates of clofibrinic acid as a metabolite of clofibrate that occurs in sewage treatment plants were low in either case at 25 % to 36 %.

Besides the often superior elimination performance of the biomembrane filtering process, an additional advantage of this system in waste water treatment is the retention of antibiotic-resistant microorganisms for which a steady increase in the water discharged from waste water treatment plants has been demonstrated. *(III 3.5, II 1.5)*

Phosphorus in sludges

The *Sewage Sludge Ordinance (AbfKlärV)* defines ways of analysing certain ingredients. Two methods are adopted for determining phosphorus which are both capable of assessing the total phosphorus content in sludges. Organic phosphorus and other phosphorus compounds which are more difficult to access are thus detected. It is not until it has been converted by biological degradation or conversion to more easily soluble phosphates that the total phosphorus in its full mass is available as a nutrient to plants.

Orientating surveys of different sludges are currently underway in order to determine the extent to which phosphate phosphorus is available as a nutrient to plants. The calcium acetate lactate method (CAL method) is used for this purpose. This method is specified in the *Sewage Sludge Ordinance* for soil analyses with regard to "plant-available phosphate" and is also used for advisory programmes on fertilisers. It was developed specifically to determine plant-available nutrients. The buffer system consists of salts of organic carboxylic acids which are also released in the root area of plants in order to improve phosphate solubility. An aqueous extract of the sludge is made under defined conditions (pH, temperature, quantity ratios) and the phosphorus content is determined photometrically.

Depending on the source of the sludge and the waste water treatment process during and after chemical or biological phosphate elimination, the total phosphorus content of the sludges analysed ranged from 0.8 to 2.1 % of the dry mass. The plant-available phosphate content determined by the CAL method was analysed at 0.2 to 0.4 % of the dry mass. This corresponds to 20 to 25 % of the total phosphorus contained in the sludges. This means that a fraction of the phosphorus content can be classified as plant-available phosphate.

These surveys confirm that the *Sewage Sludge Ordinance,* through an incorrect method for analysing phosphorus, supplies a value for plant-available phosphorus that is falsely five times higher. The phosphorus value, when measured correctly, questions the agricultural use of sewage sludge because a "major benefit" can no longer be proven. *(III 3.6)*

Department IV: Safety of Chemicals and Gene Technology

Division IV 1:

Safety of Chemicals – Environmental Testing

Environmental assessment of medicines

Since the beginning of the 1990s, repeated findings of medicinal agents in groundwater and surface waters have been the object of public attention. Since the revision of the *Pharmaceuticals Act* in 1998, the Federal Environmental Agency (UBA) has – within the scope of approving medicinal agents – been examining the risks which the proper use of veterinary medication may pose for the environment. The examination of human medicines is current being prepared.

In 2000, the Agency handled 20 applications for approval of veterinary medication. In eleven of these cases, the documentation submitted was incomplete and additional documents were requested. Three preparations were approved but with certain environmental protection restrictions, and in the case of two preparations, the UBA refused approval within the scope of the decentralized licensing procedure on a European level due to the expected negative effects, particularly on waters.

The UBA has been actively involved in the updating of the guideline by the European Union on the environmental assessment of veterinary medicines. With a view to the environmental assessment of human medicines, evaluation concepts and criteria have been worked out which will enable environmental assessment within the scope of the licensing procedure. A two-year research project that is to look into consumption volumes of active agents in human medicine and selected veterinary medicine has been commissioned to the Institut für Umweltschutz und Qualitätssicherung Dr. Kriegel, Potsdam, in order to be able to identify possible risk areas for the environment. *(IV 1.1)*

Comprehensive reports and background information are available on many of the topics. Literature from the Federal Environmental Agency (UBA) can be purchased from Werbung und Vertrieb, Ahornstraße 1–2, 10787 Berlin, telephone +49 30/2 11 60 61, telefax +49 30 2 18 13 79. Material is also available free of charge from the UBA's Central Answering Service, Bismarckplatz 1, 14193 Berlin, telephone +49 30/89 03-2400, 2422, -2304, telefax +49 30 89 03-2912. A directory is also available here free of charge that lists all publications by the UBA. Information concerning the entire range of information available, as well as summaries of selected publications, are also available on the Internet at: www.umweltbundesamt.de, under "Issues".

Assessing the risks posed by new substances

The UBA assesses the environmental risks posed by new substances (refer to chapter 11) that must be registered by the manufacturer or importer under the *Chemicals Law*. In 2000, 108 new substances were registered in Germany. These substances cover 10 different areas of application (figure 40).

Due to incorrect or incomplete documentation, additional documents have been requested for nine of these substances. Risk assessments were prepared for 59 substances, 37 were classified as being "environmental risks" and must be labelled accordingly. The results of the risk assessments for the new substances registered are as follows:

Conclusion I: No additional information required before a marketing volume of 100 tonnes per year (tpa) is reached = 40 substances
Conclusion II: When a marketing volume of 10 tonnes per year (tpa) is reached, additional information/test proof required = 11 substances

Conclusion III: Additional information and proof of testing required immediately = 6 substances
Conclusion IV: Immediate risk-reduction measures required, dialogue with the applicant introduced = 2 substances

291 new substances were registered in the other EU member states. In 1999, 19 substances reached marketing stage 1 (100 tpa) in the EU and 1 substance reached marketing stage 2 (1,000 tpa). *(IV 1.1)*

OECD's Test Guidelines Programme

Chemicals are evaluated on the basis of internationally recognized and harmonized methodological standards. According to these standards, the data of interest for the assessment is identified concerning physical and chemical properties, degradability and accumulation as well as the possible effects of the substances in question on the environment and health. International recognition and the harmonization of the methods applied are the precondition for the world-wide acceptance of these test results by regulatory authorities. Double work and unnecessary animal testing for assessing chemicals can thus be avoided. The Organization for Economic Co-operation and Development (OECD) with its Test Guidelines Programme, TGP, provides an important "Organizational roof" for developing, revising and adopting testing methods for chemicals. *Further information is available on the Internet at: www.oecd.org/ehs/test.*

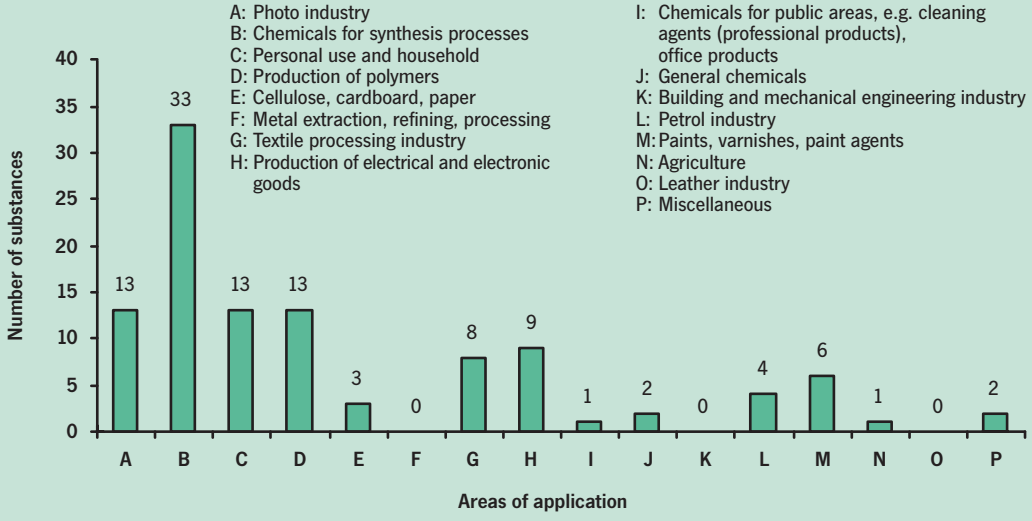
The "National Co-ordinators" (NCs) are responsible for co-ordinating the work of the OECD on a national level. These co-ordinators appoint experts, include recommendations from their own country in the TGP and draw up national positions on the basis of reports by experts (www.oecd.org/ehs/test/flags.htm). The UBA is responsible for this task in Germany.

From drafting a new testing method to its international discussion and approval is a long process right up to official acceptance as an *OECD test guideline.* In order to make this procedure more efficient and transparent, new procedures were introduced in 2000.

Each proposal includes a brief project description containing details of the foreseeable benefits of the method for assessing chemicals, the scope of applicability, the time and work still required, as well as issues related to animal protection. Based on the project descriptions and in view of national interests, the NCs grant priorities to the project proposals (high, medium, low). Based on these priorities, the OECD secretariat each year draws up a ranking and a work plan that are used to assign existing work capacities.

The involvement of the expert network and the preparation of testing method drafts ready for ratification are now also more systematically organized.

Figure 40: Number of new substances registered in 2000 and broken down into areas of application



The new procedures introduced help to ensure that only sufficiently developed proposals for methods are included in the programmes.

In 2000, a total of ten OECD test guidelines and guideline documents were officially adopted. Another 39 drafts were still in the discussion and approval process at the end of the year. This work also focuses on the concentrated validation (assessment) and further development of testing methods for evaluating endocrine (hormonal) effects. *A recent overview can be found on the Internet at: www.oecd.org/ehs/test/testlist.htm. All the drafts are available here in full-text versions. (IV 1.1)*

Risk assessment and risk reduction within the scope of the EU Existing Substances Regulation

In 2000, the EU Commission published the 4th Priority List for Existing Substances (refer to chapter 22), so that now a total of 140 prioritary substances are being tested pursuant to the *EU Existing Substances Regulation* for the fields of environment, human health and industrial safety.

The member states have drafted risk assessments for 78 of these substances, and the scientific/technical discussion in the Technical Meetings on EU level have been finalised for 41 substances. Of these 41 risk assessments, three come to the conclusion that there is no further need for action. Additional data is required for five substances before final conclusions can be drawn. *Summaries of the risk assessments are available on the Internet at: ecb.ei.jrc.it/existing-chemicals*.

The risk assessments have identified a need for action in the case of 33 substances, so that the leading member states must draft risk reduction strategies. This has already taken place for ten of these substances.

Six substances have gone through the complete procedure right up to the publication of the recommendations by the EU Commission.

In 2000, the UBA has completed environmental risk assessments for the following eight substances:

- Ethylene diamine tetraacetic acid (EDTA) and sodium salt (NaEDTA)
- Benzene
- Ethyl hexyl acrylate
- Phenol
- 2-ethoxyethanol
- 2-ethoxyethyl acetate
- n-propanol.

The risk assessments are prepared throughout the EU in a uniform manner pursuant to the relevant provisions of the related technical guideline directives. The specifications contained in the guideline for risk assessment primarily make it possible to assess the risk posed by a chemical substance for the environmental compartment of surface waters. Only rough models exist for the other areas (sediment, soil, air, but also marine environment) that at the very most enable a rough estimate of the risk to the environment. However, since the existing prioritary substances are at times discharged in very large volumes into these compartments and are often also available as exposure and effect data, including measurements in the environment, procedures must be developed for pan-European assessment and, where necessary, for test strategies. This is why the UBA has developed new assessment concepts for sediment, seas and oceans, soil and accumulation via the food chain (secondary poisoning) that have been addressed by EU expert-level advisory talks.

Risk assessment is necessary for many Existing substances. (Photo: courtesy of BMU)

In the event that a risk assessment reaches the conclusion that regulatory action is required, the respective member state drafts a strategy for EU-wide risk reduction. In these risk reduction strategies, suitable reduction measures are identified and possibilities for implementation are examined. In this context, options are evaluated with a view to the following criteria: effectiveness, practicability, economic impacts and possibilities for monitoring. When restrictions are recommended for the introduction or use of a substance, the advantages and disadvantages of this measure must be analysed in terms of quantity and the availability of alternative substances must be examined.

For three of the substances that are primarily processed in Germany – methacrylic acid, acrylic acid and methyl methacrylate – risk assessment is so far advanced that the UBA has began to develop risk reduction strategies for the environmental sector.

First of all, the possibilities for reducing the use of acrylic acid and methacrylic acid as soil injection agents for construction projects – in particular for tunnel construction – were examined and measures for protecting the environment were recommended. The draft for the risk reduction strategy will be discussed on EU level in 2001. *(IV 1.2, IV 1.4)*

Plant protection agents: protecting flora

When used, plant protection agents can also be emitted to areas bordering the agricultural areas treated where they can damage so-called non-target plants. This has been once again confirmed by studies in the Netherlands and Great Britain. The Federal Nature Conservation Agency (BfN) points to the use of herbicides as one of the reasons for flora deterioration.

The *EU Directive on Plant Protection (91/414/EEG)* requires that the effects on flora and fauna that do not belong to the target groups be examined. The "uniform principles for the evaluation of plant protection products in the EU member states" also set forth in this directive do not, however, provide any concrete criteria for assessing the effects on non-target plants. This is why the UBA in a joint working group with the Federal Biological Research Centre for Agriculture and Forestry (BBA) has developed the "Procedure for the systematic testing and prospective evaluation of the risk for flora" and has integrated this into the approval procedure. This approach includes concrete and transparent specifications for manufacturers and provides important information for responsible users as to how they can correctly handle the products in question. *This procedure is to be published in the Federal Gazette in 2001.* *(IV 1.3)*

Washing powders and detergents

Over 5,600 new washing powders and detergents or new variants of existing brands were brought into circulation in Germany in 2000. This includes all products from the household, commercial and industrial sectors that, following normal use, can enter the sewage system or surface waters and for which the basic recipe must be submitted to the UBA according to the *Law on Detergents and Cleaning Agents (WRMG)*. This does not include cosmetic and personal hygiene products.

The reports gathered at the UBA show that by the end of 2000 a total of 54,000 washing powders and detergents from around 4,500 companies were on the German market. Detergents alone account for a total annual volume of over 600,000 tonnes. The fact that the total volume did not increase in recent years is due to the growing number of concentrated washing powders. 308 companies have registered products for the first time with around every fourth being a foreign company.

Monitoring as required under the *Law on Detergents and Cleaning Agents* is the responsibility of the Federal State where manufacturers and distributors have their registered office. The monitoring authorities have examined at least 170 samples of detergents and cleaning agents throughout Germany in 2000. During the analysis of selected substances, 17 violations of the base recipes registered with the UBA were found and six violations of the values defined for ingredients in the voluntary self-commitments were identified. *(IV 1.4)*

Anti-bacterial cleaning products: unnecessary and damaging

For several years now, the market for anti-bacterial cleaning products has been growing with advertising focusing more and more on bactericidal, anti-bacterial and anti-microbial effect. From the point of view of the UBA, the use of substances with an anti-bacterial effect in detergents and cleansing agents is not recommended, because part of these active ingredients are

questionable from an environmental perspective and in international treaties on the protection of waters have already been identified as dangerous substances. Especially sufficiently high concentrations of biocidal agents that contain phenols and halogens could interfere with the operation of biological treatment plants. This reduces the performance of these treatment plants and hazardous substances can then end up in rivers and lakes where they can damage water organisms and affect the processing of drinking water.

Together with the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV) and the Robert Koch-Institut (RKI), the UBA has pointed out that anti-bacterial cleansing agents are basically unnecessary in households. Furthermore, cleaning with water, conventional agents that dissolve grease and protein, as well as thorough surface treatment are all that is needed in order to remove dirt and to achieve a perfectly healthy level. *(IV 1.4)*

List of officially recognized pesticides updated

The 17th edition of the list of tested and recognized pesticides and pest controls as well as the 14th edition of the list of tested and recognized means and methods for controlling vertebrate animals according to Section 10 of the *Federal Communicable Diseases Act* (now Section 18 of the *Federal Law on Epidemic Control)* were completed in 2000. This updating of the lists by the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV) was carried out in agreement with the UBA which had checked the effectiveness of the agents and the impacts on the environment. *The lists were published as supplements to the Federal Health Gazette and are now also available for the first time ever on the Internet at: www.bgvv.de.* *(IV 1.5)*

Division IV 2:

Evaluation of substances, gene technology

Information system on chemical safety

Within the scope of its substance-related executive tasks, the Federal Environmental Agency (UBA) has access to data concerning the identity and evaluation of new substances (refer to chapter 11) as well as on plant protection agents and pharmaceuticals and their active substances. It has proven to be useful to make this data available in a common "Information system on Chemical Safety" (ICS). In 2000, work began an transferring all the data gathered at different points to the information system. ICS is to provide access to identity data, facts and evaluation documents. Moreover, special sub-systems have been implemented for the administrative and evaluation procedures required for law enforcement and job handling. In order to ensure the fullest possible integration of the data sources that are available to the UBA's Department IV, the data from the IUCLID database for existing substances pursuant to the *EU Existing Substances Regulation* as well as the data for active biocide substances are also to be included. *(IV 2.1)*

Geographic Information Systems for approving plant protection agents

On 7 and 8 June 2000, the Institute for Technology Assessment in Plant Protection at the Federal Biological Research Centre for Agriculture and Forestry (BBA) and the UBA held a round of expert talks. The topic: the possibilities for a local, differentiated evaluation of the environmental **EXPOSURE** of active substances in plant protection agents by using geographic information systems (GIS).

Efforts here focused on using GIS as a means for greater flexibility in the terms of application linked to the approval of plant protection agents in order to achieve reduced imissions of plant protection agent into neighbouring biotopes. The aim here is to create thematic risk maps which will also benefit the control of protection services in the Federal States in a manner that is better adapted to regional conditions. These risk maps would class surface waters according to hydrologic data, morphology and permanent water-edge vegetation. The land surface would also be considered: small agricultural structures will be quantified according to number and surface distribution. This method should provide greater transparency and acceptance for approval requirements, as well as achieving a higher degree of efficiency in monitoring authorities. Within the scope of a pilot study in 2001, the suitability of GIS for use in this area will be looked into. *The report on the expert round of talks is available from*

Unit IV 2.2 at the UBA (address: page 166) free of charge. *(IV 2.2, IV 1.3)*

Exposure: *Pollution of water, sediment, soil, groundwater and air caused by humans.*

Exposure assessment for biocides

For most of the 23 product groups in the *EU Biocide Directive (98/8/EU),* no internationally harmonized methods are yet available for assessing their exposure. Emission scenarios describe the sources and imission paths of the substances into the environment from the relevant lifecycle phases. This is understood as the manufacture, formulation, use, product application and disposal. The scenarios state formulae that can be used to calculate the imission volume per time unit (kilos per day). On behalf of the UBA, the Institut für Umweltforschung at Universität Dortmund has gathered and compared existing approaches and methods for emission scenarios for biocides. *The survey report is available on the Internet at www.oekopro.de.* *(IV 2.2)*

Ecotoxicological testing with unicellular organisms

The latest results from environmental research have shown that protozoons – unicellular organisms with a cell nucleus, such as, for example, the slipper animalcule – play an important supporting role in the process of biological degradation of pollutants by bacteria in water and particularly in treatment plants. Protozoons themselves either degrade pollutants only very little if at all, but ensure more vital and powerful bacteria populations by eating up damaged or dead bacteria. This leads to considerably much more effective decomposition processes. This is why the European Union, triggered by the UBA, has declared a Technical Recommendation according to which the effect of environmental chemicals on protozoons is to be examined and evaluated. Preliminary studies on the development of a standardized testing system for an ecotoxicological test with protozoons have already been completed in co-operation with Freie Universität Berlin. Within the scope of a research project, suitable test systems are now to be put to the test and their practical suitability will be subsequently checked using a ring test involving participation by several laboratories in the EU. The resultant standardized OECD test guideline, that will include the pertinent evaluation criteria, will close an important gap in the assessment of the ecotoxicological effect and the biological degradability of substances in the environment. *(IV 2.3)*

Influence of plant protection agents on flora bordering arable land

The "Environmental test" by the UBA within the scope of approving plant protection agents also includes the effects on non-target plants (refer to page 169) on the land surface. Assessing the risk is difficult because in free land areas near fields there is a considerable fluctuation in population density and species frequency. In a survey by Universität Gießen, the impact of plant protection agents for the decline observed in certain species and the variability and diversity of flora bordering arable land were compared with other influence variables, in particular, changed forms of farming (fruit sequence, use of fertilizers, type of soil cultivation).

When different substances were persistently used in different application periods, a decline in species was noted which, however, could not be assigned to a single use of a particular agent at a particular time, but which was due to the use of plant protection agents on the whole. On areas bordering arable land that were cultivated without the use of herbicides for two years, there was a significantly larger number of species and greater share of coverage with herbal plants than in neighbouring sections that had been treated with herbicides. However, the type of farming also had a greater impact on the number of species than the imission of plant protection agents. It becomes clear that the decline in indigenous species that has been noted for many years in the agricultural landscape, and which is also apparently due to the use of plant protection agents, is not sufficiently taken into consideration when approving plant protection agents. The demand for integral protection of ecosystems is not being sufficiently guaranteed by today's testing on laboratory populations. This is why the survey proposes a multi-stage examination approach of the effect of plant protection agents on land plants. *(IV 2.4)*

Environmental impacts of genetically modified plants

Monitoring genetically modified plants following market approval is becoming increasingly important not

just due to the requirements of the new *EU Directive on the Deliberate Release into the Environment of Genetically Modified Organisms (2001/18/EU,* refer to chapter 11). There is an urgent need for action, because the research accompanying release has come up with indications of unwanted environmental impacts that must be taken into consideration when market or type approval is pending.

This is why the UBA, as the first institution EU-wide, organized a workshop in November 2000 on the monitoring of genetically modified plants. Over 100 participants from the European Commission, the respective authorities in the EU member states and candidate countries as well as from Switzerland and Norway took part in this workshop. Various scientific institutions, environmental organizations as well as German and European industrial associations also attended. The most important result of this workshop: in view of the pending implementation of the new directive, the exchange between experts in the member states must be intensified. It is also recommended that EU workgroups be set up in order to define in detail the monitoring requirements laid down in Appendix VII of the Directive and to agree on standardised procedures.

Assessment methods are one central aspect. These methods must be established and generally approved, because without a recognized evaluation of the results, it will not be possible to create a binding basis for action. This means that criteria must be established for evaluating results and protection aims must be defined, including the definition of the terms "unwanted effect" and "environmental damage". The precautionary principle must be given particular consideration in this context.

In view of the data that will be generated, it must be clarified in advance how this data is to be gathered and distributed on a national and EU level. This data is also to be fed into the **CLEARING HOUSE MECHANISMS** that are available to the public as information systems. Finally, all activities related to this must be linked with other relevant areas, for example, risk assessment, traceability and biodiversity research. For the purpose of greater support, further research into monitoring issues should also be carried out even prior to implementation. *The report on the meeting is due to be available in June 2002 from Unit IV 2.5 at the UBA (address: page 166).*

(IV 2.5)

Clearing House Mechanisms: *Information systems for the public, usually in electronic form. A Clearing House Mechanism exists, for example, on the Internet for biological diversity (www.dainet.de/bmu-cbd).*

Classifying substances in water hazard classes

In order to protect the environment and health, for over 20 years in Germany substances have been classified in water hazard classes (WGKs). In 1999, the new system for classification was introduced on the basis of risk records (R records). The control procedure requires that manufacturers and distributors register their water hazard class calculated in this manner with the documentation and information office for substances hazardous to water at the UBA. Following examination and confirmation by the UBA, the applicable water hazard class is then published. This requires documentation which contains the following details: information concerning the identity of the substance, the classified R records, and when applicable, the specified values assigned (in the case of data gaps), the total points calculated and the resultant water hazard class as well as the address of the person/company registering. Additional, more comprehensive details are needed for classification as "not hazardous to water". Further information on the classification and documentation procedures can be found on the Internet at: www.umweltbundesamt.de/wgk.htm. *(IV 2.6)*

Registering for classification

The documentation and information office for substances hazardous to water at the UBA has handled a total of 1,100 registrations between 17 May 1999 when the new system was introduced on 21 August 2000 (new figures are not yet available). All in all, 222 applications had to be rejected, at least temporarily, and a further 41 formal inquiries were made despite plausible classification. The most frequent reasons for rejection were incomplete details concerning the identity of the substance, contradictions to the official classification under the *Ordinance on Hazardous Substances*, unacceptable analogy conclusions (when identifiable) and different classification proposals by several applicants (double and triple registrations). Of those substances that were rejected, it was then possible to recognize more than

half after applications were corrected or on the basis of documents that were subsequently submitted. This means that a total of 1,013 registrations were confirmed in the test period.

Generally speaking, this new administrative regulation is widely accepted among manufacturers and distributors. Within one year, more classifications were documented and published than in one decade using the old procedure. It is also becoming clear that the new regulation is, thanks to harmonization with European legislation on hazardous substances, easier to understand for foreign manufacturers and distributors and simpler to convey.

The occasional problems experienced by smaller German and foreign companies usually arise in conjunction with the complexity of the classification under hazardous substance legislation rather than with the deriving of a water hazard class according to the *Administrative Order relating to substances hazardous to water (VwVwS).*

Since the water hazard class allocation is solely left in the hands of operators, manufacturers and distributors, it is not possible to check whether the substance data submitted is correct. Experience to date with the registration of different classifications for identical substances and with individual, non-plausible documentation, opens of the question as to whether the water hazard class classification procedure should be carried out as foreseen for registration in the White Book by the EU Commission on Chemical Policy from February 2001 (chapter 11). According to this book, companies are responsible for the documents submitted, however, the authorities have the opportunity to check the foundation for classification on a random sample basis. This would certainly lead to greater acceptance of the water hazard class system in Europe.

(IV 2.6)

Testing biological degradability

The degradability of organic substances is an essential criterion in the evaluation of substances in order to assess the risk for the environment. Whilst a number of standardized test procedures is already available for testing easy biological degradability, the choice when it comes to determining the inherent biological degradability, i.e. testing whether a chemical substance is degradable in principle, is much more restricted. An overview containing explanations on the test procedures most widely used is available on the Internet at: www.wgks.de/ab-bau.htm.

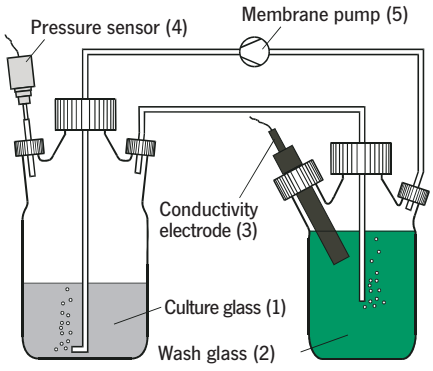
In its own experimental development project, the UBA has modified the most commonly known degradability test according to Zahn and Wellens (OECD 302 B or ISO EN DIN 9888) in such a manner that it is possible to test the complete mineralisation of such substances.

This aim can be achieved using a closed-loop test system with air circulation (figure 41). The air in the system is conducted by the test solution (1) in the circuit and subsequently by an absorber solution (2). The oxygen used up by the bacteria is measured as under-pressure by pressure sensors (4). The carbon dioxide (CO_2) that results from biological degrading is gathered in the absorber solution and leads to an electrical change in conductivity that is measured by conductometers (3). Both parameters can be determined parallel and semi-continuously by a computerized method. The test system requires very little monitoring during the 28-day test period, it is easy to handle, cost-effective, can be automated and comprises conventional laboratory equipment and material.

This test system will be proposed by the UBA as a procedure for inclusion in international standards.

(IV 2.6)

Figure 41: Diagram showing test structure of the modified Zahn-Wellens test



Management focus IV L:

Preparing for the implementation of the biocide law

Reducing risks with triorganotin compounds

With regard to tributyltin (TBT) it is known that even smallest concentrations are sufficient in order to impair the regulation of sexual hormones in sea snails. Furthermore, immunotoxic effects, i.e. effects that impair the immune system, have been documented. Similar properties may also be contained in other triorganotin compounds. Nor has the toxicological long-term action profile for mono and diorganotin compounds been conclusively clarified (refer also to page 120).

In view of the planned measures for restricting the introduction and use of organotin compounds, the UBA together with the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV) held an open hearing for experts on 14 March 2000 on the subject of "Production and use of organotin compounds in Germany". This hearing was triggered, among other things, by examinations of sports clothing that had shown the presence of TBT. At this event with representatives from industrial associations, environmental associations and ministries, the production volumes and areas of use for organotin compounds and possibilities for replacement were to be identified.

Whilst mono and diorganotin compounds are used as stabilising agents and catalysts for plastics – around 16,000 tonnes per year (tpa) in Europe – triorganotin compounds, above all TBT, are primarily used due to their biocidal action. Of the around 3,000 tonnes of TBT that are produced every year in Europe, 1,700 tonnes are exported. The remaining 1,300 tonnes are almost exclusively used as biocidal components in ship paints in order to prevent "fouling", i.e. the growth of organisms. Other biocidal applications using TBT (for example, disinfectants, pot preserving agents, preservation of heavy textiles, wood preservatives) have – at least in Germany – been widely abandoned in recent years. With regard to ship paint, it has been noted that there are already TBT-free replacement products on the market with a comparable durability.

Early 2001, the Federal Government passed on the *Draft for a National Ordinance Banning TBT* to the European Commission requesting its approval. This also foresees further restrictions for the introduction and use of organotin compounds. In order to support the effort by the International Maritime Organization (IMO) in aid of a global ban on the use of ship paint containing organotin compounds such as TBT, this type of use is to be completely banned by 1 January 2003. Furthermore, the introduction of organotin compounds in the biocidal treatment of heavy textiles (tarpaulin for tents and lorries) and of certain commodities (clothing, nappies) as well as in wood preservatives is to be banned. *(IV L)*

Central Administration

Division Z 1:

Administration and project supervision

Staff

The number of jobs at the Federal Environmental Agency (UBA) fell compared to 1999 by 1.6 % to 1,015 at the end of 2000 (table 17). Comparing: employment in 1994 still totalled 1,099 jobs.

Table 17: Permanently established jobs and other positions (budget

Year	Total	Civil servants	Salaried staff	Workers
1998	1,043	476	490	77
1999	1,032	397	556	79
2000	1,015	390	549	76

Like in previous years, the number of women increased further. Table 18 shows the share of women in the different professional and salary groups.

(Z 1.1, Z 1.3)

Training

In 2000, a total of twelve school leavers were trained as "Administrative Clerks" at UBA. Four trainees were taken on. Training primarily took place in the Central Administrative Division. In addition, ten "Chemical laboratory technician" trainees were trained in the department units.

Furthermore, eleven junior lawyers and 69 university trainees together with seven young people who had finished their "Voluntary Ecological Year" were given the opportunity to train at our administration or to gain practical experience at the UBA. Four short-term trainees, three pre-graduates, one scholarship recipient and 21 school trainees were also welcomed by the Agency. *(Z 1.1)*

Budget

The UBA budget for the year 2000 totalled around EUR 87 million (table 19). The increase against 1999 is due to the fact that investment in construction projects was adapted to the actual time schedule.

(Z 1.2)

Division Z 2:

Documentation, data processing and IT user service

Development of IT at the Agency

In 2000, the Agency's information technology was once again adapted further to meet the requirements of the UBA's staff. The aim is to ensure state-of-the-art, Agency-wide, as well as safe and secure IT.

The new information and communication technology has created a new form of work, i.e. telework. This is opening up opportunities for making communication and interactive work processes efficient and service-orientated. First experienced was gained with telework. More far-reaching strategies for boosting the efficiency of administrative processes demand powerful and permanently enhanced information technology. *(Z 2)*

Table 18: Share of female and male employees

Professional group	Total	Female staff	Male staff
Senior civil service (executive)	146	21	125
Senior civil service	347	150	197
Higher civil service	324	181	143
Clerical service	356	280	76
Sub-clerical service/workers	99	37	62
Total	**1,272**	**669**	**603**

Table 19: UBA budget

	1999 target kDM	*2000 target kDM*
I. Budget of the Federal Environmental Agency		
I.1 Total expenditure	***148,603***	***169,916***
of which		
– Personnel	*95,744*	*98,105*
– Investments	*18,634*	*38,578*
– Costs of scientific publications and documentation	*563*	*563*
– Environment Information and Documentation System (UMPLIS)	*4,533*	*4,681*
– Data processing costs	*6,550*	*5,759*
I.2 Projects for Federal Agencies and third parties		
– Federal Agencies	*2,353*	*2,359*
– EU, others	*3,330*	*4,748*
II. Funds received on trust including, but not limited to, for:		
– Investments for reducing environmental burdens	*10,150*	*7,505*
– Granting of research projects (UFOPLAN)	*45,625*	*49,800*
– Environmental sample database	*8,770*	*6,770*
– Subsidies to associations, societies, other organizations		
– Institutional support and subsidies	*3,583*	*3,583*
– Project sponsoring	*9,147*	*9,147*
– Information programmes	*2,393*	*2,833*
– Advisory support in the successor states to the former Soviet Union and central and east European countries	*689*	*518*
– Advisory support for environmental protection in central and east European countries, as well as in the new independent states (NIS)	*0*	*2,351*
– International co-operation	*1,775*	*1,042*
Total funds received on trust	***82,132***	***83,549***

International co-operation with environmental information systems

The continuous monitoring of the environment, the gathering of data and the generation of environmental information, as well as sensible linking of this information are an important basis for developing political aims. This is why environmental information systems must be developed and operated. Within the scope of international co-operation (refer to chapters 1 and 2), a transform project was launched in which the UBA supports the Slovenian Ministry of the Environment in developing such an environmental information system. Large parts of Slovenia have working monitoring systems, such as air quality monitoring, quality monitoring for flowing waters, and nationwide fundamental mapping data. What is lacking up to now, however, is the experience needed to analyse this information not just on an isolated basis, but to compile this information in a suitable manner – such as in maps – and to link this data to other informa-

tion. The transform project will be particularly useful in this context.

For several years now, contacts have been established with Syria and Lebanon where the ministries of the environment are also interested in installing environmental information systems. The working basis here is, however, less developed than in Slovenia. Up till now, there were only isolated measuring campaigns on the quality of air and flowing waters. A major problem in both countries is pollution of their natural water resources by illegal landfills and excessive immissions of pollutants into waters. The environmental ministries of Syria and Lebanon have filed a joint application with the UBA for a research project from the European Union. This is to develop a working basis for an environmental information system in these countries. *(Z 2.1)*

IT equipment and training

The Agency's tasks increasingly depend on IT support. The IT applications run on a distributed platform that connects all the locations and provides access to network-based services from each workplace. The latest forms of communication (such as e-mail) are used particularly frequently in order to support the most varied forms of national and international co-operation. The Computer Centre is in charge of technical support for site-related and central services on around 40 servers with different performance levels (use of intranet and Internet, for example).

Adequate training ensures the sensible and efficient use of existing IT resources. In 2000, around 830 employees were trained in standard software and specialist applications. In addition, a site-related local service and the central IT user service are there to assist users and their 1,200 PCs. *(Z 2.2, Z 2.3)*

Joint substance data pool of Federal and Federal State governments

Secured, up-to-the-minute and comprehensive information on environmentally relevant properties of substances and preparations are vital for all areas of environmental protection and hazard prevention. In order to compile and update this information, the environmental ministries of the Federal States and Federal Government entered into an administrative agreement in 1994 in order to set up a joint substance data pool of the Federal Government and the Federal States (GSBL). This resulted in a joint substance data pool.

The joint substance data pool currently contains information on 45,000 chemical substances and another 22,000 chemical substance classes. Twice a year, the UBA sends updated information to the signatories. The data of the joint substance data pool is available to federal institutions (Federal Ministry for the Environment, Federal Ministry for Transport , Federal Institute for Health Protection of Consumers and Veterinary Medicine, Federal Institute for Materials Research and Testing), as well as the Federal States and municipalities.

A dedicated software is being developed for the joint substance data pool. Special test routines are used to check the data with regard to technical correlations within a data record and between different data records (incoming check and check module). The Thesaurus module provides correlations between individual substances, for example, between chemically pure substances (individual ingredients, such as sulphuric acid) and preparations (component substance, such as 10 % aqueous sulphuric acid). Together with seven Federal States, the UBA is developing a new research application for the joint substance data pool which can also be used as an intranet version. The joint beta test was successfully concluded in December.

The steering committee (LA) is responsible for decisions regarding the joint substance data pool. The UBA's Unit Z 2.4 is the central co-ordination office for handling the flow of data between the partners, for monitoring the annual work programme, for ensuring adherence to quality rules, for managing the steering committee's affairs and for accounting matters. Work groups of the joint substance data pool develop specialist concepts, such as the definition of quality standards. The UBA is involved in all these work groups. *(Z 2.4)*

Hazardous substance quick information service

The hazardous substance quick information service is the predecessor to the joint substance data pool and has been available at the UBA since December 1989. 103 external online users are currently registered, including public and municipal environmental offices as well as fire brigade headquarters. Around

8,600 different substances can be researched. In 2000, around 1,500 queries were sent to the hazardous substance quick information service and processed. *(Z 2.4)*

Environmental literature and environmental research database

For some years now, the UBA has been operating the ULIDAT environmental literature database and the UFORDAT environmental research database (refer to chapter 4). These central databases are available to the public online, on CD-ROM and on the Internet at: isis.uba.de:3001. The data contents once again grew substantially in 2000 (table 20). *(Z 2.5)*

Table 20: Development of the ULIDAT and UFORDAT databases

Database	*Inventory (Data sets)*	*Growth in 2000 (Data sets)*
ULIDAT	*400,000*	*30,000*
UFORDAT	*65,000*	*5,000*

Environmental law databases

Since May, the environmental law databases (URDB) have been run by a public-private partnership. Erich Schmidt Verlag (ESV), Berlin, offers these databases under the name of "Umweltrechtsinformationssystem (URIS)". URIS combines the UBA's URDB (legal and administrative regulations of the EU, the Federal Government, the Federal States, international conventions and decisions) with the existing full-text collection of ESV publishers. ESV produces the URIS CD-ROM and operates the Internet site (www.umwelt-online.de) with the latest legal texts. The UBA is responsible for quality assurance of the contents. *(Z 2.5)*

Water/waste documentation on the Internet

Now that the printed version of the "Water/waste documentation" is no longer available, the UBA is now offering on the Internet up-to-date reference information on "Water and the Environment" as well as "Waste and the Environment" from the ULIDAT environmental literature database (www.umweltbundesamt.de/uba-datenbanken/d-db-uba.htm). *(Z 2.5)*

Specialist library for the environment

The specialist library for the environment is a service for the Agency's staff and for the interested public in Germany and abroad. It is open to visitors in Berlin at the building located at Bismarckplatz 1 and Corrensplatz 1 as well as the Bad Elster branch during regular working hours.

In 2000, the library's inventory increased by 8,000 volumes to around 367,000. Around 840 magazines are subscribed on all fields related to the environment. Online access to magazines became possible for the first time in 2000. At present, the UBA has full-text access to 65 magazines in electronic formats.

Around 24,000 users accessed the library's services and 30,000 monographs were taken out on loan. The user file contains the names of 10,000 external users. The number of uses of magazines by UBA staff totalled 60,000. The comprehensive exchange of material, for example, with around 440 exchange partners in Federal authorities, Federal State institutions and scientific organizations in Germany and abroad ensures that the library is kept up to date. *(Z 2.6)*

Library and EDP

The aDIS/BMS library management system that was developed using aDIS software supports the most important library functions, permitting smooth handling of literature and magazine stocks.

The BIBLIODAT library database provides not just the monthly lists of new titles for what now totals around 100 individual users and institutions, but also 18 selection bibliographies on such subjects as eco-balances, environmental policy and sustainable development. This information is available in printed format or online on the intranet or Internet.

Besides the online library catalogue (OPAC), users have access to additional research PCs where the ULIDAT environmental literature database as well as selected CD-ROM databases in the Agency's computer centre can be accessed in so-called simple dialogue. *(Z 2.6)*

The environment in the information society: fourth round of Dessau talks

"The information society – implications for environmental protection": This was the motto of the fourth

round of Dessau talks held on 8 September 2000 in Stadtsparkasse Dessau. The panel discussion chaired by Prof. Dr. Andreas Troge, President of the Federal Environmental Agency (UBA), was attended by: Prof. Dr. Dr. Franz Josef Radermacher, Director of the Research Institute for Application-orientated Knowledge Processing, Ulm; Dr. Reinhard Höhn, Senior Officer for Environmental Protection and Product Safety at IBM Deutschland; Dr. Karlheinz Steinmüller, Project Manager at the "Secretariat for Future Research ", Gelsenkirchen; Dr. Gerhard Finking, research assistant of the SPD parliamentary party.

The colourful discussion made one thing clear. Information and communication are fundamental tools of globalization. These techniques have substantial ecological, economic and social implications. Integrated political action and concepts are required in order to make sustainable information technology a reality.

Within the scope of this round of talks, the participants identified a concrete need for research (eco-balances for information and communication products, monitoring of lifestyles. It also became clear that strengthening environmental education will play an important role for the sustainable information society. Furthermore, the definition of boundary conditions for sustainable information technology can only be successful in an international context. National policies are not adequate for this. *(Z 2)*

Fourth round of Dessau talks: National policies are not adequate. (Photo: UBA/Rosenbusch)

Management focus ZL KLR:

Introduction of cost and results accounting

In order to define in further detail possible applications for cost and results accounting (KLR), a prototype was implemented with the software system selected. This prototype permits hands-on testing of the cost and results accounting concept that was largely developed by a consultancy firm. Cost and results accounting is employed to compared costs and results in order to measure and even improve economic efficiency more precisely. The trial phase covered two aspects of cost and results accounting: recording time and quantities for technical work, on the one hand, and data input to the IT system on the other.

As this system also includes modules that are suitable for budget planning and budget implementation, as well as procurement and taking inventory in accordance with traditional accounting principles (cameralistics) for public institutions, a prototype was created for these applications as well. The units involved developed a requirements catalogue on the basis of this prototype.

Around 100 employees in the department units and around 25 from administrative units took part in this trial run that was carried out for around 10 % of the UBA's products from 10 July to 15 September 2000. The trial phase was preceded and followed by training and advice.

The results of the work with the prototype supplied the main points of the final cost and results accounting concept. All the major components have been tried and tested with the IT system used and can go into practical operation following minor improvement. The following aspects of the prototype can be improved:

- The time and quantity data is to be entered online at the workplace and sent to the cost and results accounting unit via the internal network.
- The time required for recording time and quantity data is to be reduced by simpler and more concise data acquisition forms.
- The product catalogue is to be optimized, in particular with regard to relevance, precision of definitions and completeness.

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- The number of products will be reduced to around 300 for the UBA. Certain products are to form product groups and product areas for internal control and external reporting.
- Results accounting or results analysis for the UBA are to be defined in more detail as a superior scientific agency of the Federal Government.
- Recording quantity data for repetitive products is to be improved.

(ZL KLR)

President's Office/Press Office

The Federal Environmental Agency (UBA) aroused substantial media interest in 2000 for the subjects of eco-tax, climate change and climate protection. Two well-founded analyses by the Agency were in great demand: the eco-balance for used paper and the eco-balance for beverage packaging systems in view of the discussion on mandatory deposits on disposable bottles. The guideline on indoor air hygiene in schools (page 125) also triggered strong demand for background information. Another topic that was widely covered over an extended period of time was veterinary medicines found in the soil – strongly fuelled by the persistent crisis in the meat industry due to BSE (bovine spongiform encephalopathy, "mad-cow disease") and misuse of medication in pig fattening.

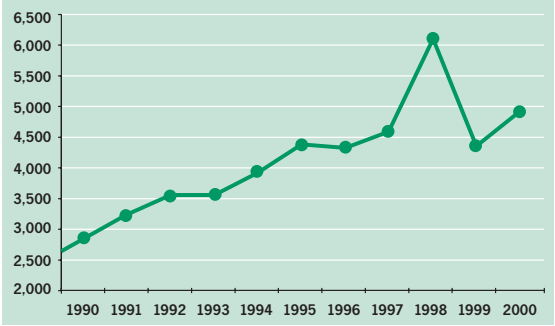
The UBA has registered a growing trend in the demand for background and explanatory information. In response to this, the Press Office provides background papers by mail, fax or on the Internet. This includes comprehensive information on ecological tax reform, eco-balances, the Climate Conference in The Hague and on ecological investing. Not to mention practical, consumer-related information, for example, concerning environment-friendly products, household tips and quality labels. The media workshop on "Soil" was another example of first-hand background information for journalists.

The traditional further-education event for the public health service is jointly organized by the UBA together with the press offices of the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV), Robert Koch-Institut (RKI), Paul-Ehrlich-Institut (PEI) and the Federal Institute for Pharmaceutical and Medicinal Products (BfArM).

In 2000, the Press Office received around 4,800 written (post, fax, e-mail) and telephone queries. This marks an increase by 500 against 4,300 in 1999 (figure 42). Interest in environmental issues (refer to chapter 4) is hence as strong as ever. The number of interviews, however, was slightly down: UBA staff were interviewed on radio and TV 310 times (1999: 330). This does not include 46 interviews and short contributions in the print media (1999: 55).

A total of 99 press releases were issued by post, fax and e-mail (1999: 97). Apart from numbered press releases, which are distributed to all the press recipients, the UBA also issues press releases on specific issues to selected specialist media, such as agricultural magazines, or titles on waste and disposal. E-mail subscriptions are available for all the press releases which can be additionally viewed on the Internet. The archive contains all the press releases since 1996 at (www.umweltbundesamt.de, under "Press Releases").

Figure 42: Press contacts from 1990 to 2000



The list of Internet addresses for environmental protection issues (Environment on the Net) is still as popular as ever. The latest edition from March 2001 contains more than 270 addresses (March 2000: over 220). The criterion for the Press Office is not necessarily quantity, i.e. the largest possible number of entries, but quality, i.e. an information offer rich in substance. *The latest version of "Environment on the Net" is available on the Internet at: www.umweltbundesamt.de. Free printed copies are available from the UBA's Press Office (address: page 2).*

(PB/Press Office)

Build-Up Staff Dessau

On 6 October 2000, the State Civil Engineering Office in Dessau handed over the Wörlitz railway station to the Federal Environmental Agency (UBA) (see photo on page 8). Since then, the Vice-President and the Build-up Staff Dessau have taken up their work in this listed building.

Parallel to this, planning work on the new office building that will connect to the old railway station has progressed further. The architect firm of sauerbruch hutton architekten (sha), the engineers and building management have completed the necessary planning documents which are also referred to as the budgeting basis for the building. Within the scope of this task, the UBA has reached important targets and defined these more precisely. Following the approval granted at the beginning of 2001, it is now possible to implement the concept and ecological requirements linked to this model project:

- The standards of the currently valid thermal insulation ordinance are being outperformed by 43 percent. This means that even the requirements of the future *Energy Saving* Ordinance will be outperformed when the building is completed.

Eye-catcher in the Dessau gas district: UBA's exhibition announcement board. (Photo: UBA/Hagbeck)

- As things stand, annual power consumption is forecast at 35 kilowatt hours (kWh) per square meter of gross floor space. This includes both technical equipment such as computers and the cafeteria.
- Earth-to-air heat exchangers will be used for ventilation. The thermal content of the exhaust air will be used for heat recovery.

Dessau and the region as a correspondence region were closely linked to the EXPO 2000 world exhibition. On this occasion, the UBA presented the new office building as an ecological model project in an exhibition in Dessau. This exhibition, which was opened daily from 9 June to 31 October 2000, offered pictures, explanatory texts, simulations, models and model components of the future Agency building, attracting 3,500 visitors from Germany and abroad.

The UBA's new building was also presented at an exhibition in October by the Dutch Ministry for Construction and Environment at an international conference on sustainable building in Maastricht.

Moving the Agency to Dessau means a giant step for its staff. In order to clarify further steps, such as ensuring good connections and personnel matters, staff were once again interviewed about their personal relocation plans at the beginning of the year 2000. It was confirmed that most of the staff do not plan on moving to Dessau even after the Agency has relocated. Most employees plan on commuting by rail to their new offices in Dessau at varying intervals.

The second edition of the exhibition catalogue on the new building in Dessau is now available. An English version is also available. Free copies of both versions can be obtained for the UBA's Central Answering Service (see box on page 94). *(AS DE)*