


Federal Environmental Agency

Annual Report 1999

Umwelt
Bundes
Amt 

For Humanity and Environment

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Foreword

As the “New Style Agency”, the Federal Environmental Agency, also known as the UBA, has been much talked about since its formation in 1974. Since then, the UBA has often provided the initiative for German environmental policy, supplied the facts and made suggestions – for new regulations and limiting values as well as for new techniques and processes. Over the past twenty-five years, it has become a partner for the administration and industry, for associations and initiatives – and not least for the general public. Even if we were not always of the same opinion, and sometimes even ruffled each other’s feathers: The large number of congratulations which the UBA received on the occasion of its 25-year anniversary in July 1999, reiterates that we are on the right track.

However, we do not rest on our laurels. Our aim is to be a modern, service-oriented official body. An external sign of this is the new layout of the annual report. The contributions are briefer and more reader-friendly than previously. “Jargonese” has been avoided wherever possible. The overview chapters with the broad, general topics of the past year – from climatic protection through to product-related environmental protection, from sustainable development in towns and municipalities through to water protection strategies – follows in a second part. Here the individual departments provide brief and clear information about project results and other news.

A focal point of the UBA’s activities in 1999 was “Environment and Health”. The clear increase in asthma and allergies shows exemplarily how much need for action there is in this field. Much too little has



been registered to date on the harmful effects of fine particles in the air on human health. The possible consequences of noise are also becoming increasingly evident: more frequent release of stress hormones and cardio-vascular illnesses. Not least, infection protection also requires more attention. The changeover from the Federal Epidemic Control Act to the Protection Against Infection Act makes this obvious.

The UBA pointed out the risks of hormonally acting substances at an early date. Moreover, in our opin-

ion, too little investigation has been carried out into what consequences the release of genetically engineered plants might have.

It goes without saying that we do not keep our knowledge to ourselves. A large amount of information is also available on our Homepage in the Internet (<http://www.umweltbundesamt.de>), part of which in English as well. The number of visits to this site has risen continuously; in 1999 they numbered almost 1.7 million.

The new head office of the UBA in Dessau (Saxony-Anhalt) is currently taking shape. The exhibition on the new head office being a part of the World Exhibition Expo 2000 has been setting a sign in the correspondence region of Saxony-Anhalt. In 2000, the civil engineering works will commence for the architecturally attractive and also ecologically trend setting project. It is intended to be a model for future administrative buildings – an example that ecology and economy can definitely be united in consonance.

My thanks go to the staff, who have made extraordinary efforts despite ever-scarcer resources.



Prof Dr Andreas Troge
President

The Federal Environmental Agency – a modern, service-oriented authority

The Federal Environmental Agency (UBA) was established by an Act of Parliament of 22 July 1974 as an independent Federal authority based in Berlin. It is expected to move to Dessau in 2003. In 1999, a brochure was published to mark its 25th anniversary.

The UBA has the following functions:

- To provide the Federal Ministry for the Environment with scientific assistance in the areas of pollution control and soil conservation, management of waste and water resources and with respect to the health-related aspects of environmental protection, notably in the elaboration of legislation and administrative regulations.
- To research and develop the foundations for appropriate forms of action and to test and investigate processes and facilities.
- To set up and maintain an information system for environmental planning as well as central environmental documentation; to measure widespread air pollution; to inform the public about environmental matters.
- To provide central services and assistance for departmental research and for the coordination of the Federal Government's environmental research and to support the federal government in evaluating the environmental compatibility of measures.

To fulfil these tasks, the UBA also carries out its own scientific research.

In addition, the UBA is also responsible for a range of other functions (see list on page 7).

To meet the international obligations of Germany, the Agency is represented in 349 committees, including 62 institutions of the United Nations and 29 of the Organisation for Economic Cooperation and Development (OECD). Employees of the UBA are involved in a total of 105 committees of the European Union (EU).

Personnel development

The currently expected relocation of the UBA to Dessau in 2003 (see article on page 148) has already had significant effects on personnel management. Employees are leaving the UBA for family reasons, to take up alternative employment in Berlin. This leads to a loss in experience for the Agency. At the same time, it also offers the opportunity of gaining new employees and therefore new impulses for the Agency's work.

Therefore, the topic of "Personnel Development" is of particular significance. It is an element of the modernisation of the administration, which is necessary due to scarce resources and increasing costs consciousness. By autumn 2000, a concept for personnel development is planned to be produced in cooperation with the administrative office and the staff council. The aim is to deploy the existing personnel optimally and to gain new, qualified personnel. Particular importance will be placed in training and further training. The UBA expects all participants to profit from this: in the form of greater work quality and increased work satisfaction.

Staff and budget details are given in part 2 on page 142.

Organisation

The UBA was reorganised in August 1999.

The structure continues the basic principles of the UBA's reorganisation in 1994 which provided that Department (FB) II "Environment and Health" formulates future environmental requirements from the viewpoint of protecting man and the ecosystem, which are then transformed into technical measures in FB III "Environmentally Compatible Technologies – Procedures and Products".

Functions of the Federal Environmental Agency (Selection)

Environmental assessment authority for new substances and assessment authority for so-called “existing chemicals” under the *EC Existing Chemicals Regulation*.

Participation in the enforcement of the *Plant Protection Act*, the *Genetic Engineering Act*, the *Lead-in-Petrol Act*, the *Medical Preparations Act* and the *Act on the Dumping of Waste at Sea* as the managing authority.

Receiving and assessing information about detergents and cleansing agents according to the *Washing and Cleansing Agents Act*.

Permitting authority for activities in the Antarctic pursuant to the *Act for the Implementation of the Environmental Protection Protocol Treaty* of 4 October 1991 to the Antarctic.

Involvement in the implementation of the soil conservation concept, the rehabilitation of former waste disposal and industrial sites.

Operation of the environmental specimen bank and reporting on the results of analyses.

Management of the “Pollution Abatement Investment Programme”, together with the Deutsche Ausgleichsbank (DtA).

Management of projects supported by the Federal Ministry of Education and Research (BMBF)

Office for storage and transport of substances hazardous to water

Information and documentation office for substances hazardous to water

Contact office under the Basel Convention

National focal point for UNESCO on environmental education

Participation in awarding the eco-label and promoting environmentally friendly products, notably in the public procurement sector

Central office for recording, reporting, and assessment of hazardous incidents (ZEMA)

National reference laboratory for EU monitoring of air pollution

Implementation of the *EC Directive concerning integrated pollution prevention and control (IPPC Directive)*

Implementation of the *Act for Protection against Aircraft Noise*

Office of the Joint Commission of the Federal Government and the Federal States on environmental information systems

Coordinating office for supporting the tasks of the joint central substance data pool of the Federal Government / States (GSBL)

Cooperation centre of the World Health Organisation (WHO) for monitoring air quality and for combating air pollution

Cooperation centre of the WHO for drinking water hygiene

Performance of tests within the scope of Article 10c of the Federal Communicable Diseases Act

Tasks in connection with the European Environment Agency (EEA)

- National focal point (coordination of German contributions)
- National reference centres for air quality, air emissions, inland waters, marine and coastal environment, soil and waste
- European topic centre for air emissions

Tasks connected with the preparations for the accession of Central and Eastern European Countries to the European Union



The headquarter of the Federal Environmental Agency in Berlin, Bismarckplatz 1. (Photo: UBA)

Department (FB) I “Environmental Planning and Environmental Strategies” (see page 94 ff.) remains responsible for general specialist problems. It has been significantly augmented by the allocation of “Energy” tasks.

FB II “Environment and Health: Water, Soil and Air Hygiene, Ecology” (see page 107 ff.) unites large parts of the former FB II “Environmental Quality and Environmental Requirements” and FB V “Institute for Water, Soil and Air Hygiene” [1]. The central aspect was to concentrate the environmental media related capacities of the UBA in balanced departments for the protected elements “Ecology” and “Health-related concerns of Environmental Protection” (Environmental Hygiene).

The internal structure of FB III “Environmentally Compatible Technology- Processes and Products” (see page 124 ff.) consists – as previously – of sections dealing with specific branches, which are responsible for evaluating not only the production processes but also the products of these branches taking a cross-media approach. The new Division III 3 “Waste and Waste Water Management” amalgamates tasks previously realised in various departments.

FB IV “Chemicals Safety and Genetic Engineering” (see pages 136 ff.) has essentially remained unchanged. It has been made responsible for the enforcement of Article 10 c of the *Federal Communicable Diseases Act* – due to its relationships to the enforcement of other laws in the field of substances control legislation, both with respect to content and formally. It was further given responsibility for the “Investigation and Assessment of Substances Hazardous to Water”. The incorporation of this task into FB IV furthers the necessary harmonisation of chemicals assessment approaches used under chemicals transport and hazardous incidents legislation.

A management task force has been set up to develop structures for the enforcement of the *Biocides Act*.

The Central Administration Department (see page 142 ff.) has now concentrated its functions into two divisions instead of three. Division Z 1 “Administration and Project Management” also includes the legal department and the administrative supervision of environmental research plan (UFOPLAN) and other support projects. The departmental structure of Division Z 2 “Documentation, Data Processing and User

Services" has been adjusted to meet the modern requirements of a client-server structure.

The Central Administration Department also includes the management taskforce "Introduction of Cost-Performance Analysis to the UBA" (see below). The reorganisation has resulted in the UBA now having some 50 fewer sections and units. The number of divisions was reduced by 7 to 16.

The UBA has taken further steps towards modernising itself – with the aim of becoming a service-oriented authority. These include:

- An evaluation as to the extent to which actual practices of the agency are oriented to the guidelines agreed in 1998;
- "Quality Assurance in Reorganisation": The task is to ensure that the aims and intentions of the reorganisation are put into concrete terms and realised;
- Staff development planning;
- Producing a planning and management information system including the introduction of cost-performance analysis.

Introduction of cost-performance analysis

The cost-performance analysis (CPA) pilot project at the UBA is supported by the Federal Ministry of Finance. Following several months of preparations, in the middle of 1999, work began on producing the concept. The CPA took on clear contours during 1999. At the same time, it became clear that this new instrument can also be applied to the tasks of a scientific federal authority without any methodological problems and with good promise.

CPA is necessary to generate the information required to manage an authority in a way that is more strongly geared to the services it provides. It should enable the employees of the UBA to be more directly responsible for their own work.

The typical tasks of the UBA, above all in Departments I, II and III, can not be easily expressed in the form of projects or so-called repetitive products as offered as output types by standard CPA to date. Therefore, these tasks were described in the form of specialist topics, including details about aims, results, scheduled dates, and quality requirements

and each description is completed by a short summary.

At present, the total output of the UBA is divided into

- main products,
- specialist topics and
- projects.

CPA makes sense for main products. In the case of specialist topics set up for the long term, the output cannot be quantitatively recorded. In this case, precise verbal descriptions and details about scheduled dates are more expressive.

The specialist topics have been uniformly organised into so-called pre-products essential to producing the respective results. These include appropriating specialist knowledge and integrating internal and external research projects. The preproducts for each specialist topic are used as cost units in the CPA. Projects have a defined beginning and a fixed end, i. e. the time at which the project has produced a result. An important part of the work to implement CPA at the Federal Environmental Agency CPA is producing and validating the lists and catalogues of the internal and external main products, specialist topics and pre-products.

The development work with the detailed CPA concept and a functional IT system should be completed by the end of July 2000. Effective operation should be introduced gradually from autumn 2000. The subsequent training and adaptation phase is foreseen to finish in mid 2003, before UBA's relocation to Dessau. Thereafter, routine permanent operation can commence.

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[1] The Institute for Water, Soil and Air Hygiene of the former Federal Health Agency was incorporated in the UBA with the effective date of the Health Institutions Reform Act (GNG) on 1st July 1994.

Part 1:
Part 1:

For Humanity and Environment:
General topics
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General topics**

1. Results of environmental monitoring

To perceive changes in our environment, we are to observe them. There can be different types of reasons for doing so.

For example, we direct our attention to extreme weather phenomena. We register the seasonally unexpected occurrence of tornados in the USA. We register extreme summer temperatures in Central Europe and the occurrence of animal species in the North Sea which are otherwise only known of in warmer climatic zones.

We do this, because such changes could reveal signs or even evidence of a global climatic change. In this case, we therefore observe changes in our environment based on a hypothesis which is assumed from a scientific point of view, but whose time dimensions have not yet been able to be verified by concrete perceptions.

However, scientists also observe changes in the environment without being guided by such hypotheses.

With the occurrence and identification of the new type of forest damage at the start of the eighties at the latest, we had to acknowledge that environmental changes are not always the result of simple cause-effect relationships. Here it became clear that changes in the environment could also be indicators of previously unknown relationships between load and effect. As the ability of man to describe, with foresight, all the imaginable effect relationships, not only reaches its limits for cognitive reasons, but for economic reasons too, we are well advised to carefully observe changes in our environment and to check for plausible relationships. The phenomenon of substances with a possible hormonal effect is just such an example.

Information on action

One cannot always be certain that what is currently being observed can also be interpreted with respect

to the present. We must also make provisions to be able to analyse and examine that which is observed retrospectively based on an advanced level of knowledge. This is enabled by the setting up of an archive of samples, which have been taken from the environment and stored so that an analysis of the stored samples, even many years later, can provide a correct image of their original material spectrum. The Federal Government's environmental specimen bank is a worldwide unique instrument for this purpose.

A further task of environmental monitoring is controlling the success of environmental policy measures. Traditionally, it is primarily directed at the media soil, water and air and is intended to monitor the success of the statutorily prescribed, mainly emissions-related environmental standards. According to the allocation of tasks between the federal government and the states, this core area of environmental monitoring primarily lies within the responsibility of the Länder (States).

Reporting on the results of the environmental monitoring necessarily means that the aims and methods of the monitoring have to be stipulated and the corresponding standards of assessment elucidated. Environmental monitoring leads to an abundance of information, which – taken at face value – may well have an intrinsic value, however as the basis for decisions regarding further environmental policy action, they always need to be placed in the perspective of a broader framework.

There is no doubt, the concentration of a chemical substance in a specific matrix has a certain informative value. However, the real significance of this information can only be deduced from a wide range of additional knowledge. These include specific characteristics such as persistence (resistance against environmental influences), its accumulation capacity, and water solubility or chemical reactivity. In addition, there is information about the end point of a possible effect in the organism, about the position of a substance in the food chain and about paths along

which a pollutant can get to its place of action. These are supplemented by information about the consequences of material effects due to changes in equilibria in ecosystems.

Instruments of environmental monitoring

Within the scope of its reorganisation, the Federal Environmental Agency (UBA) has created a section which tracks selected questions of environmental monitoring experimentally and at the same time places particular importance in questions that are non media-specific. In this section, which conceptionally supplements the media-related work of the Agency, highly and medium persistent compounds and chemicals are dealt with – due to their generic significance. Persistent Organic Pollutants (POP), sulphurhexafluoride (SF₆), methyl-tert-butylether (MTBE) and certain active plant protection substances are several prominent examples of this selected range of materials. In this sense, within the scope of its research, the UBA participates in concrete environmental monitoring programmes.

Monitoring programmes

One application for such general approaches stems from the international sector: In 1979, the Economic Commission for Europe of the United Nations (UN-ECE) elaborated the Convention on *Long-range Transboundary Air Pollution (LRTAP Convention)*. Within the scope of this UN-ECE agreement and its protocols, all 54 signatory countries, including Germany, are obliged to make national contributions to the joint programmes for environmental monitoring (acidification of waters, forest damage, material damage, effects in agricultural plants and natural vegetation, critical loads and levels, and integrated environmental monitoring). The six programmes, in which around 35 European countries participate, include the installation and Europe-wide coordination of environmental monitoring projects by international programme centres. The programmes themselves are managed by pilot countries. Germany is the pilot country for the programmes “forest damage” and “critical loads”. The data collected annually in Germany are available in the ECE programme centres, however to date have not been available nationally.

The UBA has access to all the international monitoring programmes mentioned. Since the beginning of 1998 it has become possible to use these data for purposes outside of the UN-ECE agreement too. The value of this classification lies in the assured data quality over long time series and the comprehensive character of the monitoring programmes.

This information can also be accessed under the address <http://www.umweltdaten.de/uid/start.html>. The large number of possible uses is also indicated there. Thus, for example, the current risk to the observed medium/ecosystem with respect to air pollution can be described by determining whether and by how much pollution limits are exceeded.

Health-related environmental monitoring

Health-related questions are tracked by the Federal Environmental Agency with the environmental survey and the human organ samples bank.

The environmental survey records data of 4,800 examined persons who are representative of the resident population of Germany. It was carried out for the third time in 1998 and for the first time ever, included the whole of Germany. The evaluation of the samples was not agreed until the beginning of 1999. Nevertheless, several trends can already be identified. Thus, a previously observed reduction in lead levels (in the blood) and arsenic (in the urine) continues. However, the values for mercury (in blood) and cadmium (in urine) have hardly changed. The values show that impairment to the health of around 0.5 % of the adult population cannot be reliably precluded. The standards used for this assessment are the human biomonitoring values of the UBA. These are standard values in the sense of uniform national orientation standards for environmental medicine.

The drinking water values for lead, copper and zinc have changed mainly in the “neuen Länder” (former GDR): The fall in average lead levels is counterposed by a significant increase in copper and zinc. Cadmium appears to have hardly changed. Measured against the values of the soon to be rewritten *EC Drinking Water Directive*, in Germany the lead levels would be exceeded by 5 %, copper by 2 % and nickel by 13 %.

A characteristic of the human organ samples bank – as well as the environmental samples bank of the Federal Government – is the archiving of the sample material over long periods. Apart from the input analysis routinely carried out, these archived samples are available if problem substances that have not been monitored or hardly investigated to date in the bodily pollutant load of humans are to be recorded and their changes over time made visible.

At the 1998 Dioxin Congress in Stockholm (organised by the Swedish environmental agency), a strong increase in polybrominated flame retardents agent was reported in Swedish human milk samples.

Therefore, in 1999, 20 full blood samples (10 female and 10 male) were taken from the Münster student group of the sampling years 1985, 1990, 1995 and 1999 of the environmental samples bank and were investigated for residues of polybrominated diphenylethers and for the residues of other POPs.

Although the investigations have not yet been completely assessed, a trend can be determined which shows that polybrominated diphenylether is present in archived human blood samples in the Federal Government's environmental samples bank in concentrations comparable to those in Swedish human milk samples. Prognoses, as were published in Sweden for human milk samples (doubling of the contents within 5 years) can not be so clearly confirmed for Germany based on the results of these investigations. To be more meaningful, these investigations should be supplemented by the determination of polybrominated diphenylether in archived human milk samples.

Investigation of marine and limnic organisms

Such retrospective monitoring was carried out on the environmental samples of this archive for several hormonally effective chemicals (alkylphenols, bisphenol A and organotin compounds) in marine and limnic organisms. The findings signalise that the ban on the use of paints containing tributyltin (TBT) on ships less than 25 metres long has not resulted in any significant reduction in the pollution of aquatic ecosystems. The TBT values measured in the tissue of sea organisms (mussels) during the whole sampling period 1985 to 1996 – depending on their

location – lay 9 to 17 times above the critical concentration ranges stipulated by the OSPAR Commission. The degree by which these values are exceeded is alarming and was the reason for measures being taken by the Federal Government.

A further result that is considered disquieting stems from the retrospective monitoring of the alkylphenolethoxylate (APEO) group of substances. In fact, the use of APEO was reduced by approx. 85 % between 1986 and 1997 due to a voluntary undertaking of the industry. However, investigations on mussel samples from the environmental samples bank from the Wadden Sea do not reflect this drastic reduction in usage. Although the 4-nonylphenol content in mussels from the Lower Saxony Wadden Sea fell between 1985 and 1992 from 9.7 to 3.5 micrograms per kilogram fatty tissue ($\mu\text{g}/\text{kg}$ FG); in the following years varying concentrations were verified with an upwards trend, so that in 1996, contents of 5.2 $\mu\text{g}/\text{kg}$ FG had again been established. A similar result has also been obtained for the Schleswig-Holstein Wadden Sea.

Water and soil quality criteria

Since the beginning of the 90's, assessment standards have been developed for waters first and recently for solids too, to protect free-living bio-coenoses. The basis for water and soil quality criteria is formed from data on the effects of substances (primarily from laboratory tests for key species and biological processes). The thus determined quality criteria should reflect structures of the ecosystems – frequency (abundance) and diversity of the species – and functions (such as the mineralisation of nutrients). The stipulation of quality criteria is not only based on scientific criteria, but also includes evaluated conventions for risk equalisation. It is therefore imperative that the quality criteria are tested in the real loading situation of a body of water, to be able to deduce assessment standards for practical water monitoring from quality criteria in the enforcement of the specialist states' administrations.

In a close cooperation between the Federal Government and the Länder, the target levels for waters have been deduced for industrial chemicals, metals and plant protection products (PPP) and checked with respect to their significance for determining action to be taken. Initial results of the checking of the

target levels for PPP from North Rhine Westphalia show that only 13 of 33 products are found in negligible concentrations in waters. However, the overwhelming majority frequently (3), sporadically (6) or rarely (11) exceed the target levels.

Ecosystemic environmental monitoring

Since 1997, the UBA, together with the States of Bavaria, Hesse and Thuringia, has sponsored the pilot use of ecosystematically organised environmental monitoring in the Rhön biosphere reserve.

The special feature of this approach, as repeatedly underlined by the German Council of Environmental Advisors (SRU), is the meaningful connection between systems theory (functionalities) and questioned (hypotheses) approaches. To this end, ten environmental problems, deemed globally and nationally relevant, were selected and differentiated into 150 partial hypotheses on the causes and consequences of environmental changes.

The inner structure of these hypotheses (arranged into causes, primary effects and secondary effects) corresponds with national and international approaches for the selection of environmental indicators (OECD, CSD, EEA).

This systems theoretical approach serves to ensure the functionality and efficiency of individual ecosystems or of the overall balance of nature in the description of future environmental conditions.

(// 1)

2. Access to environmentally relevant information

The Federal Government and the Länder boast a wide range of valuable environmentally relevant information. The efforts to combine this information and to make it available to all have made huge advances in recent years. The projects GEIN for the public and FINDEX/GSBL for authorities show how access to national environmentally relevant information can be created. At the same time, they are examples of good co-operation between the Federal Government and the States.

GEIN – The German Environmental Information Network

The German Environmental Information Network (GEIN) provides access to the information spread over the web sites of numerous public institutions such as the environmental authorities, Federal and State agencies, ministries and thus serves as an information broker for environmental information in Germany. The information offer includes the environmental data catalogues (UDK) of the Federal Government and States. These are meta information systems which contain information about environmentally relevant data sets. The data are maintained by the respective institutions and are not or only partially directly accessible via web sites. The information offer for the Federal Government sector was amalgamated, updated and extended in the UDK-UBA.

GEIN, on the other hand, is not an in-house project of the authorities, but is targeted at the general public. With the new GEIN system, the knowledge on environmental topics which is available in the Federal Government and the Länder is also made available to the members of the public in the internet. In this way, the information providers fulfil their duty to inform the public as provided for in the *EC Directive for Free Access to Information about the Environment (90/313/EEC)*, the *Environmental Information Act* and international agreements such as the *Århus Convention*. In addition, the system also enables the

Federal Environmental Agency (UBA) to fulfil its international cooperation tasks.

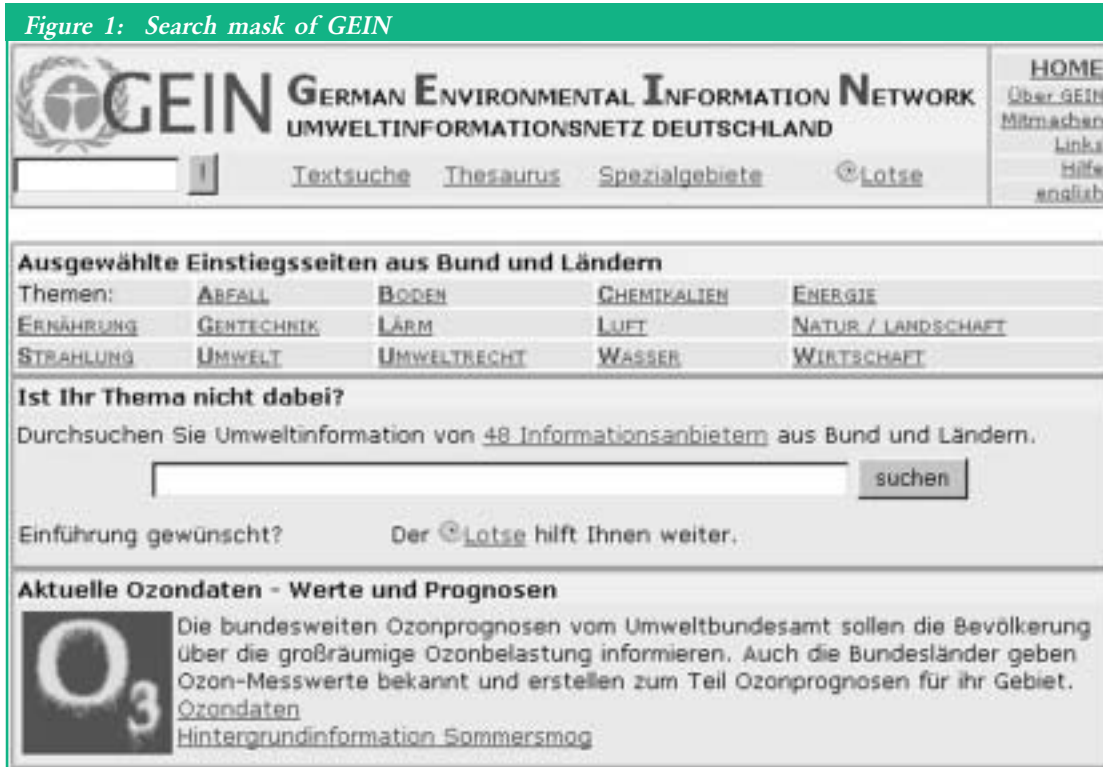
The German Environmental Information Network GEIN is being developed within the framework of a research and development project of the environmental research plan (UFOPLAN) under the title GEIN 2000. The project is sponsored by the Federal Ministry for the Environment (BMU) and the UBA, and implemented by the UBA. The participation of the Federal Government and the States in the control of the project is ensured by three committees. Apart from the steering committee with representatives from the BMU, UBA, and the Federal Agencies for Nature Conservation (BfN) and Radiation Protection (BfS), the States are also represented in an advisory board and a project group of the Federal Government/State environmental information systems working party (BLAK UIS). The advisory board accompanies the project with respect to the specialist subject data offer, the project group at a technical level.

The Environmental Information Network is being created from the amalgamation of the individual information providers and the information broker as the central service in this network. The information broker is responsible for the communication between the users and the information offers. It accepts the enquiries of the users, passes them on to the information providers and then passes the results back to the questioners. In addition, it also provides tools to integrate the information offers themselves in the network.

The information offers, which are made available via the broker, not only have a different type of content but are also made available by the information providers in different forms. Firstly, there are static web sites, secondly, so-called dynamic web offers, in which the information normally first has to be accessed by the user in a dialogue via menus or via database accesses.

GEIN offers both: It makes not only the static but also these dynamic web offers accessible to the gen-

Figure 1: Search mask of GEIN



eral public. Particular importance should be placed in this functionality, because such databases primarily contain specialist data and can therefore for the first time ever, can be researched together with other information.

A part of the information has been made accessible by the information providers on a uniform subject basis, to make structured searches in the web facilities possible. The basis of this subject-based access provision to the information offers is the Environment Thesaurus and the GEIN/GISU Geo Thesaurus of the UBA.

By focussing the circle of information providers, incorporating dynamic web offers and preparing the data of the information offer by subject, the performance of the German Environmental Information Network stands out from the usual search engines.

Routes to information

Various possibilities are available to the users of GEIN for finding information (Figure 1).

A topics catalogue is offered for a rapid entry to the environmental information. Here the user can browse a little and gain an overview of the topics. In addition, the catalogue leads the users straight to the most important start information of the information providers.

If the user already has a specific question, GEIN offers key words for searching. The advantage of this search is that the question can be spontaneously formulated. It can be disadvantageous that if the key words are too general, a large, unmanageable number of search results are found; because in this search, the direct occurrence of the text in the information offers are sought.

If the user is able to describe their query in more detail, GEIN offers the possibility of allocating the key search words thematically, spatially and in terms of time. The detailed search targets the information offer made accessible by the information providers according to specialist criteria. Depending on the user's wishes, they can be guided by a "search assistant" from the outset. Starting with the key search words entered, the assistant determines and suggests matching terms from the words stored by subject (Environment Thesaurus and Geo Thesaurus) for the

search. To find the time-reference of all types of different environmental events, an "environmental calendar" is available. The special search enables more specific access to selected topics, for example, according to "literature", "projects" or "material information". Here the users are offered search categories matched to the respective offer.

Development of GEIN is based on the new Internet standard XML (eXtensible Markup Language). GEIN uses XML for the administration of its application data together with the XML database Tamino. Both the integrated Environment Thesaurus and the Geo Thesaurus are stored in XML structures. The access to the information offers by subject (award of key words) with the aid of these thesauri is also stored as an XML index in the database.

The interface to the information providers with dynamic information offers is also formulated in XML. To do this, an XML-conform profile was produced by GEIN, which can be analysed and evaluated by a parser. The information itself does not have to be available in XML-format. Apart from the internal interface to the information providers, GEIN also provides an interface to the outside. The external interface is formulated in the XML-application Resource Description Framework (RDF). The advantage of using RDF compared to pure XML is that not only the data but also their descriptions can be made available to be read mechanically by outsiders.

The GEIN application consists of Java servlets, the whole of the communications takes place via the HTTP protocol. The conception and development works for the GEIN 2000 project were commenced in 1998 and were mostly completed during 1999. With the start of the EXPO 2000 in Hanover on 1st June 2000, the German Environmental Information Network will have been completed and will be available to the users with its connected databases.

The German Environmental Information Network can be found under http://www.gein.de/index_en.html.

Joint central material data pool

Since 1994, the UBA has been working on describing material information centrally and making it available both in-house as well as nationally.

To do this, two different approaches are pursued: In a holistic approach, the material information is held in single knowledge storage with a uniform specialist subject model. Furthermore, the meta information system approach is used, which leaves the information about the materials in their original context, but refers to this information available in a central system. The meta information system itself is a material database with all the necessary information for identifying the substances. The references give information as to in which special material database special information about a material is located.

The first approach with its central, database based knowledge storage has the advantage for the user of uniform access to the data with the aid of only a matched subject model. All information is prepared for the knowledge storage. This knowledge storage forms the core of the common material data pool of the Federal Government and the single States (GSBL).

The Federal Government and the States have committed themselves to cooperate in collecting, updating and providing uniform and reliable information about environmentally relevant or hazardous chemical substances. By the end of 1999, the administrative agreement had been entered into by the Federal Government and 15 States. A steering committee formed with representatives of all the contract partners manages the GSBL and sets the work programme. The special guidelines are produced in GSBL working groups which avoids work being carried out twice on the material data.

The GSBL data is characterised by a uniform attribute description and identical special requirements made of the data quality. The information from different data sources is transferred into the data model of the GSBL.

The special GSBL data model includes facts on the following generic terms:

- Data for materials identification (such as structure, registration numbers of external systems)
- Legal properties (such as national and European chemicals law, transport law, pollution control law, soils law, water law)
- Physical-chemical data (such as melting point, solubility, redox potential)
- General hazards
- Health hazards, first aid

- Information for the fire service for dealing with the materials, as well as within the occupational and of health consumer protection
- Environmental behaviour/ecotoxicology and
- Toxicology.

The current GSBL data inventory combines data from the "hazardous substances rapid information" (GSA), the chemicals information system (CHEMIS), the information and communications system for hazardous/environmentally relevant substances in North Rhine Westphalia (IGS), the hazardous substances database of the states (GDL), from the on-call service and initial deployment information system RESY, data from the Beilstein Institute and fire service specific suggestions for action of the Institute of the Fire Service in Heyrothsberge as well as transport provider related data of the Federal Institute for Materials Research and Testing (BAM).

Metainformation system FINDEX

The second approach has been operated since 1996 with the production of a metainformation system under the name FINDEX.

Contrary to GSBL, the FINDEX is only used internally at UBA.

The FINDEX is also a materials database, i.e. the stored references to information always refer to a specific material.

After a prototype FINDEX had been realised in 1997 with the materials of the common materials data pool of the federal government and the states, from the *Chemicals Act (ChemG)* database and the implementation of the plant protection products (PPP) database, all other relevant materials databases used in the UBA were subsequently prepared for connection to the FINDEX. These include

- The European existing chemicals database EU-CLID
- the database for water pollutant substances RIGOLETTO
- the database of the implementation of the Washing and Cleansing Agents Act (WRMG)
- The ABIOTIKs database with data on the abiotic degradation in the atmosphere and
- The SYSIPHUS database with information on production plant and manufacturing methods

with environmentally relevant pollutant emissions.

In recent years, a complete operator centre has been set up for materials databases, which provides important support for the specialist and organisational processes in the operation of materials databases. These primarily automated processes are necessary, as a large number of incoming and outgoing data flows have to be dealt with by GSBL and FINDEX. The most important functions that can be carried out with the aid of the operator centre software are:

- Import
- Export
- Registration/Standardization
- Updating materials
- Checking data
- Development of a materials thesaurus
- Decentralised data acquisition
- Administration of processes with respect to the operator centre

Presentation of the materials information

As a result of the project for the development of FINDEX, a prototype research interface has been available since 1999 using the possibilities of webtechnology. Apart from materials research in FINDEX (including structure and partial structure search), this research interface also allows direct access to the materials information in GSBL from FINDEX.

This facility will be gradually introduced for all other connected materials databases by the end of the year 2000.

In addition, from the year 2001 a comfortable material data research will also be available which can be either used as a rapid client-server solution or as an internet-compatible application, as required.

This internet research solution will also be able to be used to make selected material information available to the public within the German Environmental Information Network (GEIN). To achieve this, it will be linked to the Environmental Information Network via an interface.
(Z 2.4/PG FINDEX)

3. Climate protection and the turning point in energy policy

Protection of the climate continues to be a central task, not only of the environmental policy. The main reason for the greenhouse gas emissions caused by man is the consumption of fossil fuels. The combustion of fossil fuels is made responsible for more than 50 % of the additional greenhouse effect. Therefore, new paths have to be taken in the energy policy. The focal issues are the rational and economical use of energy, increasing energy efficiency and increasing the proportion of renewable energy. New accents were also set in Germany with the intention of phasing out the use of nuclear energy. In 1999, the activities of the Federal Environmental Agency (UBA) were concentrated on providing scientific assistance to the turning point in energy policy, on the way to sustainable energy management.

Effects of energy utilisation on the biosphere

Permanent, environmentally compatible utilisation of energy is important for sustainable development. Energy is a vital component of economic growth in the developing and industrial countries. However, the need for energy is also one of the main causes for destruction of the environment: Degradation of soil, deforestation, losses in the variety of species (biodiversity) and desertification are particularly serious examples. A large part of the destruction of the environment is due to energy supply. According to the forecasts, without massive measures to save energy, energy consumption in Europe will rise by over a third in the next 30 years, the worldwide increase is forecast as over two thirds. The aims of the Kyoto Protocol for the Climate framework convention for the reduction of greenhouse gas emissions will have failed drastically in the industrial countries, if the current production and consumer pattern does not change.

Climate protection as a challenge

The greenhouse effect caused by man (anthropogenic) is the central, global challenge. It endan-

gers the natural basis of our existence. The first effects are already visible today:

- Increase in the global temperature in the past 100 years by around 0.3 to 0.6 °C;
- Warming of the oceans with increased evaporation and atmospheric precipitation as well as more and stronger storms;
- Worldwide melting of glaciers
- Melting of the Arctic ice mass by 40 %;
- Increase in the sea level during the last century by more than 10 cm;
- Numerous coral reefs are dying back;
- Eight of the ten hottest years of the past century occurred during the past decade.

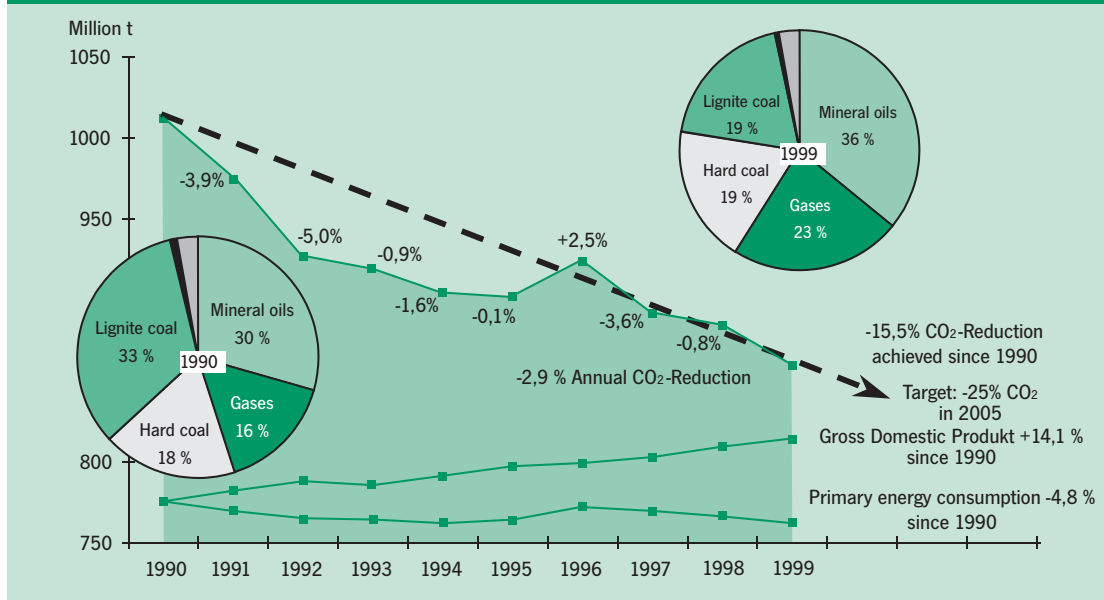
One indication of the ever more noticeable consequences of global climatic change is the increasing number of natural disasters. The insurance industry substantiates this with comprehensive statistical data. Yet nevertheless, during the past five years the worldwide emissions of the most important greenhouse gas, carbon dioxide (CO₂), rose again more quickly – to the present level of around 23 billion tonnes per year. Climatic protection can only be partially achieved by laws. Decision makers in industry and politics as well as the general public must be informed of the relationships between climatic changes and climatic protection, to be able to act independently. Against this background, the UBA has started important activities, for example

- Participation in the world conference “Clean Energy 2000” sponsored by the United Nations in Genf;
- Cooperation with the German Army (Bundeswehr) which is not only a player but also a multiplier for active climate protection;
- Cooperation with associations in industry and society as well as with local Agenda 21 groups, the Länder (States) and parliamentarians.

Development in climatic gas emissions in Germany

In 1999, emissions of CO₂ in Germany reduced by around 3 % compared to the previous year. Thus, the

Figure 2: CO₂ Emissions in Germany and the proportional of emissions from fossil energy carriers



Source: Daten AG Energiebilanzen, Jan. 2000, UBA assessment

CO₂ emissions in the period of 1990 to 1999 were reduced by 15.5%. They therefore still lie within the target corridor for CO₂ emissions, which has to be maintained to achieve the national climatic protection target of a 25% CO₂ reduction by 2005. Apart from Germany, only the United Kingdom, Luxemburg and Switzerland were able to show a reduction in CO₂ emissions. In most western industrial nations, the emissions rose, contrary to the internationally accepted obligations, some even rose very significantly.

Comparison of the CO₂ emissions with the total primary energy consumption (TPEC) and the gross domestic product (GDP) shows that a slight reduction of the TPEC and a strong increase in the GDP can reconcile climatic protection and economic growth (Figure 2). The ratio of CO₂ emissions and BIP fell significantly between 1990 and 1998 by 26.1%. Economic growth has successfully been decoupled from energy-related CO₂ emissions.

Results of the research project "Political scenarios for climatic protection II" show that without further climate protection measures, the expected CO₂-emissions remain clearly above the climate protection targets.

Other studies in which the UBA has participated on behalf of the Federal Ministry for the Environment (BMU),

have also confirmed that the climatic protection targets will not be achieved without additional efforts and political decisions. However, they also show that these – and more far-reaching – aims can be achieved solely by phasing out nuclear energy. (Figure 3).

Due to the large quantities emitted, CO₂ is by far the most important greenhouse gas. In Germany, CO₂ emissions account for more than 85% of the total greenhouse gas emissions. The obligations according to the Kyoto Protocol on emissions reduction affect five other greenhouse gases (methane, di-nitrogen oxide, perfluorinated hydrocarbons, fluoro-hydrocarbons containing hydrogen and sulphur hexafluoride). The UBA and BMU have reported on appropriate emissions reduction strategies within the framework of the *EU Council Decision for a system for the monitoring of CO₂ emissions and other greenhouse gases in the Community (1999/296/EC)*.

The "Win-Win Strategy" for climate protection

Leitmotiv for motivation of the climate protection players is the change from an energy management, which was dominated by thinking in categories of energy production, to a demand-oriented network structure, which can be economically and ecologically opti-

mised. This paradigm change is not an unwholesome burden for society, but, according to the "Factor 4 Approach" of Lovins, Weizsäcker and Hennicke, a "Win-Win Strategy" for climatic protection. Instruments and measures for climatic protection provide multiple benefits: Relief for the environment, individual economic profits and permanent, new jobs. The UBA has underpinned the "Win-Win strategy" to climate protection with two research projects:

- "Saving energy – climate protection that pays"
- "Jobs from climate protection".

The results of the projects were presented at a top-level German-American Workshop held in Berlin in February 2000. For America which is crucial for the international climatic protection discussion and which fears disadvantages for its economy due to climatic protection, the argumentation using the "Win-Win strategies" of climatic protection is particularly important.

Climate protection creates jobs

Employment policy matters have a high priority. The UBA has had the employment effects to be expected from climatic protection measures investigated in a research project at Prognos AG, Basel. Based on the "Political Scenarios for Climate Protection II", an innovative method was used to determine the effects on jobs of a climate protection scenario for individu-

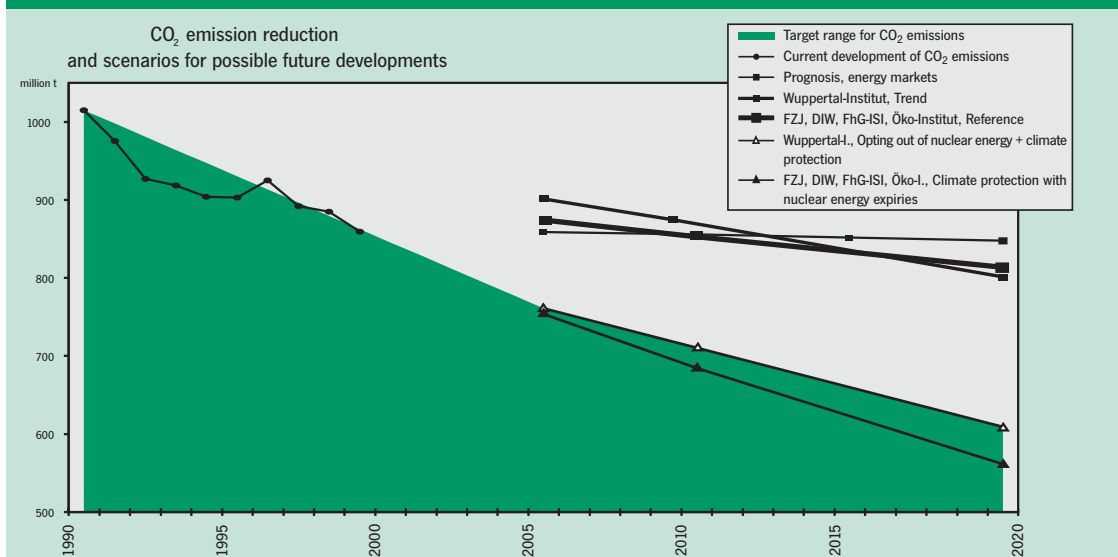
al economic sectors. They were compared against a reference scenario, which equates to a "business as usual" development. In the year 2005, a total plus of 155,000 jobs results for the climate protection scenario. Particularly positive effects result in the construction industry, in mechanical engineering, in the transport sector, in the mineral rock & earths industry and in electronic engineering.

Thus, the development described by the climate protection scenario not only leads to the national climate protection target being achieved, but could also make a noticeable contribution to improving the employment situation in Germany. Ambitious climate protection creates new sustainable jobs.

Combined heat and power generation in the liberalised energy market

The liberalisation of the electricity market has been implemented in Germany with considerable dynamic. Mainly because of the surplus electricity-production capacities built up during the monopoly times, significant electricity price reductions have ensued, initially for commercial customers, then – to a lesser extent – for private households too. Combined heat and power generation (CHP) is especially affected by this. Due to takeovers, the CHP plants in particular are not built or even shut down early, although from an environmental point of view they are particularly favourable.

Figure 3: Scenarios for CO₂ emission reduction



Without the maintenance and development of the combined heat and power generation, and in particular the cooperative power-heat industry (electricity and heat are generated for the mutual consumption in industry and municipalities that are closed to the industrial site), the climate protection target of the Federal Government will fall a long way short.

Against this background, the following activities for the development and protection of the environmentally friendly CHP are a central concern of the UBA:

- Research project "CHP in the liberalised energy market" under the responsibility of the Wuppertal Institute;
- Networking comparable work at other institutions;
- Cooperation with the groups and players involved, to place the use of CHP for climate protection in Germany on a broader footing;
- Cooperation with the mass media with the aim of making the somewhat awkward term "combined generation of heat and power" accessible to a broader public;
- Promoting effective demonstration projects within the scope of the investment programme (inter alia in Warendorf, Pfaffenhofen, Gütersloh and Wiesloch);
- Providing scientific assistance to the Federal Ministry for the Environment with respect to CHP relevant regulations in the *Ecotax Act*;
- Preparatory work for the design of the statutory CHP regulations (*Act for the protection of electricity production from CHP*, Certificate trading model)

Cumulated energy demand

Sustainable energy management should not be allowed to remain merely a vision; it must be practically prepared and quantified for decisions politics, industry, science and for consumers. A suitable parameter for such decisions can be the cumulated energy demand (CED). It is the sum of all energy quantities for a product or an energy service along the conversion chain from the primary energy extraction to the end storage or discharge of waste heat into the environment.

A project carried out by a working party formed by the Öko-Institut, the Bauhaus University of Weimar and the Institute for Industrial Construction Research at the University of Karlsruhe showed that it is possi-

ble to use the CED to produce an initial rough check of environmental impacts of energy intensive products and services. A "Brief Ecobalance" (Screening Life Cycle Assessment, LCA) carried out with CED is compatible with the relevant ISO standards (International Organization for Standardization) and equates to the level of the discussion in SETAC (Society of Environmental Toxicology and Chemistry). However, CED cannot replace ecobalances.

CED also provides important basic information for ecobalances and eco-audits. The project results are available in the Internet (<http://www.umweltbundesamt.de/uba-info-daten/daten/kea.htm>). They are also available as a brochure and CD ROM. (I 2.5)

Renewable energies

The utilisation of renewable energies in Germany also rose strongly in 1999. Subsidy programmes have significantly improved the favourable environment for the utilisation of renewable energies. In the case of energy production from renewable energies, the *Renewable Energy Sources Act (EEG)* of 25th February 2000 was further developed. Thus, the operators of plants for energy production from renewable energies were given the necessary degree of planning and investment security.

The leader in the development of new capacities for the utilisation of renewable energies in 1999 was again the utilisation of wind energy. With around 1,600 megawatt of newly installed capacity, it has reached a total capacity of 4,500 megawatt and thus now already contributes two percent of the electricity production in Germany. Overall, the share of renewable energies in electricity production now lies at almost six percent.

An environmental research plan (UFOPLAN) research project completed in October 1999 shows in detailed scenarios that it is possible to at least double the share of renewable energies in the German energy mix by the year 2010. Such a development requires well-aimed and mutually co-ordinated assistance provided by a whole range of measures. The study also shows that all the branches of renewable energies will be needed if the ambitious development aims are to be achieved. Apart from wind energy, bioenergy, solar energy and geothermics must therefore also increasingly raise their share in the German energy mix by a significant amount.

Stand-by losses

A reduction in the demand for electricity can make an important contribution to the reduction of the CO₂ emissions. Above all, this can be achieved where energy consumption has no benefit for the user: For example in electrical appliances, if they consume energy without fulfilling their actual function, i.e. when idle. Idle running is much more than merely being on stand-by – for example it also includes unnecessary permanent operation and putative “off” state. In private households and offices in Germany, related to the situation of 1995, no-load losses in electrical appliances waste at least 20.5 TWh per year (1 TWh = 1 terawatt hour = 1 billion kilowatt hours). The UBA and the BMU have repeatedly pointed out this wastage and have called upon efforts to be made to reduce them, inter alia in a brochure.

Suggestions for reducing stand-by losses were successfully made at meetings of the Energy Council of the EU. One possible instrument is the so-called One-Watt Plan. This provides for electrical appliances not consuming more than 1 Watt during standby – to be complied with by new appliances from the year 2010 at the latest. With this regulation, the stand-by losses in the private households and offices in Germany would fall by 90 %. The International Energy Agency (IEA) has incorporated this plan in its consultations. *(I 3.2)*

The high point of the negotiations, in which the UBA participated within the German delegation, was the 5th Conference of the Parties (COP) of 25th October to 5th November 1999 in Bonn.

At this conference, important impulses resulted from the speech by Chancellor Gerhard Schröder which reiterated achievement of the national reduction targets for CO₂ emissions of 25 percent by the year 2005 and which raised the demand for the Kyoto Protocol to be allowed to come into effect by the 10th anniversary of Rio, i.e. by 2002.

This requires ratification by at least 55 States with at least 55 percent of the emissions quantity of the industrialised countries. The prerequisites required for this, such as the arrangements for the regulations for the Kyoto mechanisms and the system for compliance controls, must therefore be created at the next Conference of the parties in November 2000 in The Hague. *(I 3.1)*

Climate framework convention and the Kyoto Protocol

The focus of the international negotiation process on climatic protection in 1999 lay in the implementation of the action plan of Buenos Aires. Several technical methodology orientated topics such as the “Guidelines for producing emissions inventories” as well as the contents for the pending third national reports of the industrialised countries were able to be agreed and passed.

The most important negotiation subjects were the procedures, guidelines and principles of the Kyoto mechanisms (emissions trading, Joint Implementation and the Clean Development Mechanism) as well as the design of a system of compliance controls. Advances were made and the corresponding negotiation texts further developed.

4. Sustainable development in towns and municipalities

The towns and municipalities play a key role in the implementation of the model for sustainable development. Societal and ecological problems occur particularly clearly in the cities and towns. On the one hand, most of the economic and social activities take place here, it is here where land and other natural resources are used intensively; it is here where the greatest environmental pollution is caused. On the other hand, it is the immediate environment of the residence or the region the population especially identifies itself with. Here the inhabitants experience not only environmental and development problems, but also successful measures at first hand.

Local Agenda 21

An increasing number of local authorities in Germany are participating in the Local Agenda 21 process together with their local communities. The task of the Federal Government is, taking into consideration the fundamental self-administration guarantee of the local authorities, to support and strengthen the Local Agenda 21 process in dialogue with all the institutions involved, and to identify and dismantle obstacles. In joint statements, the Federal Ministry for the Environment (BMU), the environmental ministers conference and the central local authority associations explicitly assured this. The main aim is to win over all local authorities for the process and at the same time to work more closely together.

The Federal Environmental Agency (UBA) continuously promotes the Local Agenda 21 process with various offers of information and advice: Model projects, case studies, working aids, service brochures and specialist events.

What recommendations and perspectives result for the continued Local Agenda 21 process in Germany after all in comparison with development in other European states?

The UBA commissioned a study "Local Agenda 21: European Comparison" from The International Council for Local Environmental Initiatives (ICLEI) and the German Institute of Urban Affairs (Difu), the results of which being published in 1999.

In their conclusions, the consultants point out that the Federal Ministry for the Environment and UBA have already provided important impulses for sustainable development in the municipalities via their wide range of information and advisory offers. Impulses at national level, however, must not only come from the federal authorities responsible for the environment or urban planning, but also from the departments, which are responsible for economic and social needs. A national sustainability strategy and measures that set the framework can support the Local Agenda 21 processes in their effectiveness.

At the same time, increased coordination of the tasks and responsibilities should be aimed for. Above all, initiatives at a national level make sense in public relations work and in motivating the different players. The same applies for the production of a nationwide "ideas and information pool" as well as for the link-up with international initiatives. In this context, the "Local Agenda 21" discussion group set up in the meantime at a national level, consisting of Federal Government, the Länder (States) and the local-authority associations, is an important initial step to the coordination and grouping of the various promotional activities.

In addition, according to the results of the study, it is also important for the success of the Local Agenda 21 process

- That the local authorities are given an adequate free hand, including with respect to financial issues
- Key projects are deduced from a universal target and measures plan
- The participants are made aware of the social and individual benefit and

- Indicators are developed, with which the steps on the way to a sustainable local development can be measured and assessed.

Overall, the results of the investigation showed that the German cities and towns are able to show remarkable successes on the way to a sustainable development. At the same time, they show what further action is needed. (I 2.3)

High degree of mobility with less traffic

Traffic is one of the most problematic areas in local planning. It affects – like no other – not only ecological but also economic and social matters. Sustainable development without incorporating “traffic” is unthinkable.

Despite this insight, there are significant deficits in practice. The reasons for this are only partly due to the explosiveness of traffic policy decisions. Frequently, the difficulties already occur in the run up to the planning or during the planning process. They are caused by the lack of clarity in the relationship between mobility and traffic and the lack of relevant sustainability targets and indicators. In addition, the implementation of long-lasting concepts frequently fails due to a lack of commitment in local traffic planning decisions.

In the long term, sustainable mobility is only possible with short routes mobility. It reduces the cost of transport and improves the opportunities for the most suitable and least environmentally polluting modes of transport for cities: one's own two feet and the bicycle.

Against this background, the UBA awarded in 1999 the research project “Local Agenda 21 – sustainable mobility”. In an initial step in this project, sustainability goals and indicators are being developed for the mobility and transport sector. A catalogue of quality goals and indicators should be available by the end of the year 2000. Intermediate results will be published regularly. In a second work stage, the sustainability goals and indicators will be tested in practice in two model cities.

Legal framework for planning

The traditional regulatory plan of action, which like a patchwork merely becomes active where visible haz-

ards occur, cannot guarantee effective protection against the environmental impact of traffic. This was clearly reiterated by the regulations to § 40 Para. 2 of the *Federal Immission Control Act (BImSchG)*. It is even more difficult to arrange the implementation of sustainable traffic planning based on the existing laws.

The traffic development planning of several cities already fulfils the social, economic and ecological requirements of sustainable traffic development. However, their implementation frequently fails because to date, the planning is merely a policy programme without being legally binding. This is the point at which the research project “Legally binding traffic pollution control planning – Local Agenda 21” comes in. The aim is to develop an implementable legal concept for binding traffic pollution control planning as well as to consolidate the concept in the form of a substantial draft for a *Communal Traffic Planning Act*.

This target can only be achieved if the experience of the local authorities is integrated in the research work. To this end, a comprehensive written poll was carried out at 55 local communities (35 returns). Additional interviews were held with eight local authorities. Following on from these interviews, an expert seminar was held with a total 22 representatives of the local authorities. The results of these polls and discussions: In spite of considerable advances, the overall local authority traffic planning often has many clear weaknesses in the part covering measures and enforcement. These weaknesses are also due to the deficits of the legal arrangements, and namely in particular with respect to

- The objectives for environmental protection
- Binding coordination with other planning, especially urban and regional planning and
- The distribution of competence between local authorities and State road building authorities as well as road traffic authorities.

The local authorities have a clear interest in improvements to the legal instrument. (I 3.1)

Reducing land consumption

Increasing demand for land for urban uses such as housing, commerce, traffic and leisure, increased segregation of the uses and the increase and spatial

expansion of motorised private transport are the primary causes for the continuing growth in settlements. Direct consequences are the loss and impairment of ecological spatial functions by developments, impervious surfaces and cutting up. At the same time, the growing distances between the settlement areas produce an increased need for traffic and a greater dependency on the car. Thus, the environmental quality worsens due to pollution and impairment of the natural space. This causes a relocation of living to the edge of the city and increases the development towards disperse settlement structures.

The area used for settlements in Germany has almost doubled during the past 50 years. During the period from 1993 to 1997 alone, the settlement and transport zones have increased by 4.3 %; this equates to an area that is almost as large as the States of Berlin, Bremen and Hamburg together. On average, the daily new consumption is 120 hectares. In 1997, the proportion of the whole area of Germany used for settlement and transport was 11.8 %. At least half of this area is developed and sealed.

According to trend calculations, the area of settlements will continuously increase in the future. The delimitation of areas used for settlement and transport purposes is thus one of the most important fields for action on the way to a sustainable development in the towns and municipalities of Germany.

Given this development, the Federal Ministry for the Environment included land consumption as a central indicator in the so-called "German environment barometer" which was published in the draft version of the environmental focus programme in 1998. The aim is to reduce the daily increase of the settlement and transport zones to 30 hectares by the year 2010.

A wide range of opportunities result for action to achieve the strived-for turning point in the utilisation of areas, above all at local authority level. The primary guiding principle is to exhaust the existing utilisation potential. Important approaches worth mentioning are:

- Orientating building development to the inner areas of the cities and towns by compaction of the existing building areas, mixed usage, re-use of fallow land or areas formerly used by the military

(conversion areas) as well as carrying out urban renewal measures;

- Concentration of settlement development in a region on settlement focuses and provision of regional public transport;
- Grouping transport routes;
- Ecological upgrading of the inner-city residential environment, together with measures to remove impermeable surfaces;
- Securing and networking open spaces and landscaped areas worth protecting.

Model projects for changing the trend

The topic of "space-saving settlement development" is a focal point of the work and research of the UBA. To support the efforts of the local authorities in changing the trend in the utilisation of land for settlement purposes, the UBA continued in 1999 its work in providing working aids, sponsoring model projects and keeping on the strategy discussion.

In future, to achieve the target of a drastic reduction in the utilisation of land for settlement and traffic, the primary tasks will be to combine space-saving and landscape protecting planning concepts with economic instruments for reducing and steering the demand for building land. These include

- To produce a planning concept designed for implementation to better take into consideration the environmental, recreational and residential quality of life within the scope of the inner development of towns and municipalities;
- To reorganise land tax so that is environmentally related and to introduce supplementary tax and charges instruments,
- To orientate the possibility of financial construction and regional grants to the target of achieving space-saving settlement development and
- To upgrade environmental planning.

(I 2.3)

Instruments of urban land-use planning

Sustainable zoning planning and spatial management is treated in Chapter 7 "Sustainable settlement development" of the Agenda 21. The new urban planning law (in force since 1st January 1998) also requires that the urban land-use plans should guar-

antee a sustainable urban planning development, secure a humane environment, and protect and develop the necessary natural conditions for life. Land and soil should be dealt with economically and carefully; at the same time, impermeable surfaces should be limited to the absolutely necessary. In addition to the requirements of § 1 Para. 5 *Building Code (BauGB)* to be particularly observed, a new § 1a "Environmental protecting needs in the consideration phase" has been introduced aiming at

- The presentation of landscape plans and other plans, especially those of the water, waste and pollution control laws (air quality control and noise reduction plans);
- Prevention and equalisation of the expected intervention in nature and landscape;
- For certain projects the assessment of the determined and described effects of the project on the environment (impact assessment) and
- The aims of maintaining or the purpose of protecting areas of European importance and the European bird conservation areas in the meaning of the *Federal Nature Conservation Act* (examination according to the *Fauna-Flora-Habitat Directive*).

The numerous instruments for sustainable urban development in urban planning law include inter alia

- Urban planning contract
- Project and infrastructure plan
- Official and voluntary reallocation of properties
- Permissibility of expropriation
- Town-planning development measures
- Preservation statutes
- Urban planning orders
- The preparatory urban land use plan (zoning plan) and
- The binding urban land use plan (local development plan).

To rapidly meet the requirements and possibilities for sustainable urban development in relation to the central instruments of urban land use planning, the UBA commissioned the Office for urban and regional planning, Aachen, in cooperation with Dr A. Bunzel, the German Institute of Urban Affairs, to update the working aids for "environmental protection in zoning planning" and "environmental protection in local development planning". (I 2.3)

5. Global environmental protection: International technology transfer

Many environmental problems, which are today at the forefront, have increasing international significance.

To deal with these problems, all the countries participating in the 1992 Conference for the Environment and Development in Rio de Janeiro pledged themselves to intensifying technology transfer. In Chapter 34 of Agenda 21, the availability of scientific and technical information as well as access to clean technologies and their transfer are classified as important prerequisites for sustainable development.

Apart from practical technological cooperation, for example in the form of selected bilateral projects, a continuous information flow is necessary to achieve effective technology transfer.

Information systems on environmental technology

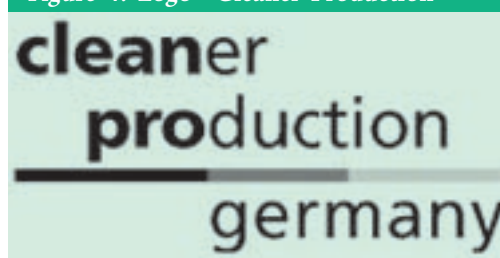
To guarantee this information flow, the Federal Environmental Agency (UBA) has produced the brochure "Cleaner Production Germany – routes to technical environmental protection" [2] together with the Society for innovative technology and management advice (ABAG-itm), Fellbach. It has been translated into three languages. The brochure brings attention to German methods of technical environmental protection as well as to the arrangement of the political and legal framework conditions which have led to innovative technical solutions. It presents how improvements to the environmental situation have been achieved in the past for air, water, and waste and which technical and organisational measures should be used to deal with future challenges.

In accordance with the requirements in the Agenda 21 to promote access to clean technologies, an internet information system on German environ-

mental technology has been developed with the Fraunhofer Institute for Systems Technology and Innovation Research, Karlsruhe, parallel to the brochure.

The web service "Cleaner Production Germany (CPG)" is available to players in the environmental sector at home and abroad. It provides topic-related opportunities for research into the German environmental technology and environmental services sector. In addition, CPG also makes it easier for contacts to be made between German and foreign players for cooperations and business relationships in environmental technology. It is available both in German and English under the web address <http://www.cleaner-production.de>.

Figure 4: Logo "Cleaner Production"



Apart from the possibility of obtaining the required information via a search engine, structured access to information on the following topics are also available:

- Technology and the environment
- Grants
- Research facilities
- Subsidised projects
- Environmental engineering and the economy
- Providers of environmental technology
- Advisory institutions
- Technology transfer

Within the scope of the “Environmental Biotechnology Network” sponsored by the Federal Ministry for Research, under the management of the Bauhaus University in Weimar in cooperation with the Witzenhausen engineering consultancy, Fricke & Turk, the “International Transfer Agency – Weimar Node – Environmental Bio Technology in the Waste and Recycling Industry” was set up. Since May 1998, it has acted as an interface between research, industry, and the authorities and since then, it has supported over 30 projects. The Weimar Node also highlights the range of biotechnology offers in the waste industry and opportunities for their use in international markets using newly developed information management systems. It also provides assistance in the adjustment of technologies to the requirements of foreign markets. (III 1.1)

Workgroups and Workshops

Apart from the work for the European harmonisation of emission requirements, the UBA has also organised workgroups and workshops on special environmental technology topics. They provide an important additional instrument to improve the exchange of information.

The EU Twinning Programme

Practical cooperation with international partners is achieved via defined projects. During the course of the project work, technical and organisational experience is exchanged and jointly tested.

Bringing the Central and Eastern European acceding countries to the environmental standards of the European Union (EU) is one of the most important tasks to be solved during the course of the EU enlargement. The high level of environmental protection should also be extended to the new member states. To achieve the target of a European Environmental Union, the EU Commission has decided to introduce a supporting development scheme: The Twinning Programme. Its main instruments are partnerships (“twinning”) in which institutions of the EU member states link up with those of the candidate countries. The EU invites tenders for twinning projects from the member states.

Since 1999, the UBA has been carrying out a series of projects or partial projects on behalf of the Federal Ministry for the Environment, which mainly last until 2001. These include:

- **Bulgaria:** Preparation for a national environmental strategy and a national environmental campaign programme; a programme for educating the general public; air measurement network; implementation of the *EC Environmental Information Directive*, wastewater, clean air and nature conservancy regulations; regulations for used vehicles, electronic scrap and old contaminated sites; nature conservancy land register.
- **Estonia:** Advising on the harmonisation of legal provisions; assistance in the set up and procedures for existing and planned clean air maintenance measures with respect to air monitoring and further education.
- **Lithuania:** Preparation for the Structure Fund development instrument for the implementation of environmental projects.
- **Poland:** Development of a national environmental strategy as a basis for the identification of environmental projects which are to be subsidised with EU funds; creation of the legal and administrative prerequisites.
- **Romania:** Assistance in the waste industry.
- **Slovenia:** Creation of the legal and institutional framework for the utilisation of the Structure Fund and the Cohesion Fund.
- **The Czech Republic:** Assistance in enforcing environmental law especially by strengthening Czech environmental inspection.

The backbone of each twinning project is the dispatch of experts from the administration of one EU member state to the respective acceding country. The actual work of transferring the community law must be performed by the ministries of the entry candidates themselves. The EU experts sent to the ministries for long-term and short-term deployment assist in this using their own specialist experience to ensure that the aims of the twinning projects are achieved in due time. In practice, a very specific knowledge and experience transfer takes place. The better this works,

the better the prerequisites created for future technology and engineering transfer.

Waste Legislation in Rumania

One twinning project: Germany assists in the transfer of European waste legislation to Rumania. The Rumanian Ministry for the Environment, with the assistance of experts from Brandenburg, Lower Saxony and the UBA will

- Examine the national waste management strategy;
- Transfer European waste legislation, with all the relevant directives, into Rumanian law;
- Develop economic structures for financing the waste industry;
- Produce cooperation models with industry and the regional environmental authorities;
- Develop waste management databases and the principles for the necessary public relations work.

The UBA has produced the work programme and will accompany the whole project in the short term, by providing the project management and one expert.

(III 2.4, I 1.2)

Other projects: Plant safety in Ukraine

The Ukrainian government is currently endeavouring to set a new legal framework for plant safety. To do this, it is orienting itself to the standards applicable in the EU. A complicated process: Many of the chemical plants have exceeded their economic service life. Due to a critical economic situation, it is to be expected that the potential danger will continue to increase.

On the basis of an outline agreement between the German and Ukrainian governments, the UBA sponsored a project in a chemical factory in Rovno.

The most important results of the project include

- A safety inventory in which the experience gained during the course of the reorganisation of the chemical industry in the „neuen Länder“, the former GDR, was applied, and
- An outline safety report according to the new *Seveso II Directive*, which can be used as the ba-

sis of analysing chemical plant in the Ukrainian industry.

Overall, the project is a standard for a results-oriented and trend setting German-Ukrainian cooperation. At the same time, reference points for European safety awareness and for an instrument for working up precautionary measures to prevent accidents were developed.

(III 1.2)

Land contaminated by ore mining in Rumania

As a contribution to the German-Rumanian programme for scientific and technological cooperation, scientists from both countries have been researching the securing of contaminated ore mining sites since March 1995. The Universities of Hamburg and Clausthal apply a bioindicator system for determining soil and water heavy metals pollution, regionally typical for Rumania. They undertake laboratory and commercial experiments to develop methods for interrupting the natural leaching from spoil dumps in high spoil mounds and tailings ponds in the Baia Mare region. The leaching from spoil dumps is caused by sulphuric acid as the result of natural weathering of the pyrites. This dissolves heavy metals present in the spoil mound rock, which are then flushed out of the spoil dumps by rainwater. High heavy metal loads of adjacent soils and neighbouring rivers and lakes are the result. Much importance is placed in the investigations, which are intended to prevent the natural leaching process and immobilise the heavy metals hazardous to health.

The Federal Agency for Geosciences and Raw Materials (BGR), Hanover, is working on the development of a new type of reactor process for the inexpensive biological cleansing of water from ore mining and processing operations containing cyanide. As a result, the proportion of cyanides discharged into the environment should be able to be drastically reduced. Events around Baia Mare in February 2000, as water containing cyanide got into the Tisza and Danube rivers, showed how urgent this project is.

The Rumanian cooperation partners carry out local investigatory work and analyses and provide the sample materials. In addition, they have participated

in the erection of the new type of large chamber percolator for field experiments in which the behaviour of the dump materials is tested under different loading and mix conditions. The scientists were provided with modern laboratory equipment. In addition an annual exchange programme for scientists lasting several weeks is attended.

Waste Disposal Logistics in China

A project oriented to the solution of waste management problems in China has been looked after by the companies FIW GmbH, Cologne, and Trienekens AG, Viersen, since 1998, in cooperation with the municipal administration of Guilin. The aim is to set up a modern system of waste collection, treatment and disposal, which is matched to the circumstances and needs of the town of Guilin. Such a system is of particular importance due to the climatic conditions and increasing tourism. The national environmental authority (SEPA) supports the German-Chinese model project, which is supported financially by the Federal Ministry of Research.

[2] "Cleaner Production Germany – Ways to technical environmental protection" is available free of charge from the Central Reply Service (see address on page 2).

6. Emissions standards – Europe-wide harmonisation with BAT reference documents

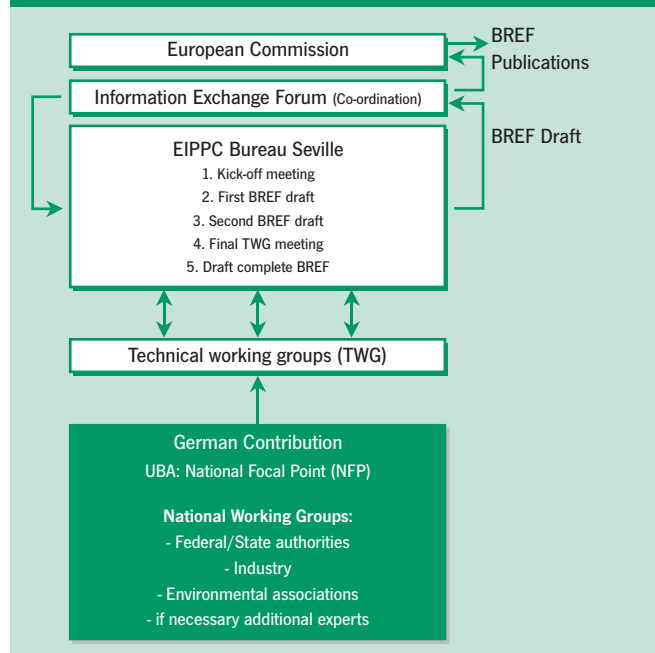
The EC Directive on Integrated Pollution Prevention and Control (IPPC Directive, 96/61/EC) dated 24th September 1996 regulates the approval of particularly environmentally relevant industrial installations on the basis of a cross-media concept. The aim is to achieve a high overall level of protection for the environment, in particular the environmental media water, soil and air. The member states are obliged to set up an integrated permitting system for the plants covered by the Directive.

An important element of the Directive is the demand for utilisation of the “Best Available Techniques” (BAT) in new and – following a transition period – in existing plants too.

The Directive provides for the exchange of information between the European Commission and the member states, industry and the environmental associations for the European harmonisation of BAT. In a work programme lasting several years which began in 1997, reference documents (BREFs) are produced in technical working groups (TWGs) on all industrial sectors covered by the Directive presenting the best available techniques in the respective sector. Each BREF takes around two years to get finalised. The European IPPC bureau (IPPC = Integrated Pollution Prevention and Control) in Seville, EIIPCB for short, is responsible for the drafting of the BREFs. Germany is represented both in the “Information Exchange Forum” (IEF) steering committee and in the TWGs by the Federal Environmental Agency as the “National Focal Point” (Figure 5).

The BREFs are not legally binding, nevertheless, they are factually important. In Germany, the information contained in the BREFs is used for the updating of the non-statutory regulations according to the state-of-the-art, for example for the amendment of ordinances or administrative regulations for the implementation of the *Federal Immission Control Act*

Figure 5: Players and phases in the production of BAT reference documents



(*BImSchG*) or the *Wastewater Ordinance* to the *Water Management Act (WHG)*.

Apart from their importance in stipulating national requirements for plants and in the provisions set in the permitting procedure, the BAT reference documents can be used by businesses as a benchmark for the environmental protection efforts achieved compared with competitors, or by the interested general public and environmental associations directly as an information source. The translation of the BAT reference documents (or extracts thereof) into all the official EU languages as well as the easy accessibility of the documents via the Internet (<http://eippcb.jrc.es>) makes it easier for them to be used, even in countries outside of Europe.

The cooperation between the Federal Government and the Länder (States) has been systematically developed and constantly intensified. Under the guidance of the Federal Environmental Agency (UBA), a working group for each sector collates reliable data about the state-of-the-art emission and consumption reduction applied in Germany and produces a German contribution to the exchange of information.

The national working groups also contain representatives of the industry concerned, environmental associations and – if necessary – further institutions

and experts, for example plant manufacturers, from working parties of the Verein Deutscher Ingenieure (Association of German Engineers – VDI), universities or other research institutions. Interested environmental associations are informed about the progress of the work by e-mail circulars.

Initial experiences and results

At present, 15 BREFs are being worked on at EU level. Tables 1a and 1b provide a summary of the work

Table 1a: Work programme and status of the work on the BAT Reference Documents

Sector	Status of the work at EU level	National activities
Work begun in 1997 Iron and steel industry Cement and lime industry Paper and pulp manufacture Industrial cooling systems	Both BREFs are to be published by the European Commission soon Final discussions planned in the Information Exchange Forum in 2000 BREF draft underway	(mostly) completed
Work begun in 1998 Non-ferrous metal production Glass industry Ferrous Metals Processing Chlorine-alkaline industry Tanneries Textile industry Monitoring emissions	Complete BREF drafts completed, currently being revised BREF draft in preparation First partial BREF draft completed. Enquiries on measuring and monitoring practices in all member states currently underway	German contributions have been made. Currently being supplemented and commented on.
Work begun in 1999 Foundries and smitheries Large Volume organic chemicals Intensive livestock farming Wastewater and waste gas treatment in the chemical industry Refineries Emissions from the storage of dangerous substances and bulk materials Large volume gaseous and liquid inorganic chemicals Cross-media and economic aspects	Work began in 1999 Work due to commence in 2000 Work due to commence in 2000	German contributions being prepared. For refineries and emissions from storage with support of research project Accompanying research projects on cross-media assessment underway.

Table 1b: Work programme and status of the work on the BAT Reference Documents

<i>Sector</i>	<i>Status of the work at EU level</i>	<i>National activities</i>
<p>Work begins in 2000 <i>Solid large volume inorganic chemicals</i> <i>Large combustion plants</i> <i>Slaughterhouses</i> <i>Food and milk processing</i></p>	<p><i>Work planned to commence in 2000</i></p>	<p><i>German contributions with support from accompanying research projects</i></p>
<p>Work begins in 2001 <i>Waste incineration plants</i></p> <p><i>Surface treatment of metals (electroplating)</i> <i>Ceramic industry</i> <i>Polymer manufacture</i> <i>Surface treatment using solvents</i></p>	<p><i>Work planned to commence in 2001</i></p>	<p><i>German contributions in preparation</i></p> <p><i>German contributions in preparation with support from accompanying research projects</i></p>
<p>Work begins in 2002 <i>Special inorganic chemicals</i> <i>Organic fine chemicals</i> <i>Non-hazardous waste disposal</i> <i>Landfill sites</i> <i>Hazardous waste disposal/recovery</i></p>	<p><i>Work planned to commence in 2002</i></p>	

programme and the current status of the work in the individual sectors. The first two BAT reference documents for the “Iron and steel industry” and “Cement and lime industry” sectors have been successfully completed and are due to be published by the European Commission.

The quality of the data has a decisive influence on the meaningfulness of the BAT reference documents. Unfortunately, the fact that uniform measuring techniques and reference times are not used, as well as the different approaches in the reporting of data, make the work considerably more difficult. These problems should be noticeably improved with the planned BREF on “Monitoring emissions”.

Difficulties also arise from the assessment of cross-media and economic aspects required by the IPPC Directive. There are not yet any conventions for a uniform methodical approach. A special TWG will commence work on this matter during the year 2000.

BREF for the cement and lime industry

The “cement and lime industry” working group has produced a very high quality BREF. It presents the following best available techniques for the cement industry:

- Dry rotary kiln with multi-stage cyclone preheater and precalcinator, achieving a specific heat consumption of 3,000 megajoules per tonne (MJ/t) cement clinker.
- Suitable techniques for limiting the emissions of nitrogen oxides (NO_x) are primary measures, staged combustion and selective non-catalytic reduction (SNCR), with which, in a suitable combination, NO_x emission values of 200 to 500 milligrams/cubic metre (mg/m³) can be achieved.
- Electrostatic precipitators or fabric filters, with which dust emission values of 20 to 30 mg/m³ are achievable
- Sulphur dioxide (SO₂): Absorbent addition to the raw material or in the waste gas flow in case of raw gas emissions under 1,200 mg/m³, wet

scrubber or dry scrubber for higher levels of raw gas emissions, with BAT emission values of 200 to 400 mg/m³.

The BAT emission values are clearly labelled as average daily values.

BREF for the iron and steel industry

This describes

- the use of fabric filters,
- partial waste gas desulphurisation and
- the injection of lignite coke powder and lime in conjunction with the use of fabric filters in sintering plants.

Some of the initial data is of a poor quality, so that in most cases, it is not possible to give clear averaging times for most of the emission values and thus a certain interpretation flexibility is opened in their use. Germany has contributed numerous, individual information about modern plants in Germany as well as producing a comprehensive comment on the partial sector "Electric arc furnaces". It is planned for publication by the UBA in early autumn 2000.

BREF for the pulp and paper industry

The document reports on widespread process-integrated measures in this branch. The present draft of the EIPPCB is in fact a compromise; nevertheless, it describes a high level of environmental protection. For example, it gives the electricity and heat consumption of reference paper mills for the production of the most important fibrous materials and types of paper. This information was previously not available, although the branch is one of the most energy intensive sectors. The state-of-the-art with respect to wastewater discharge has also been illustrated using a large number of example installations.

BREF for the glass industry

The document for the glass industry is also planned for completion in 2000. An almost complete draft already exists. A fundamental revision of the parts concerning BAT for dust emissions reduction (including heavy metals) and the reduction of sulphur dioxide emissions is currently still being worked on.

The BREF is also planned to include information on the monitoring of emissions. The UBA has, assisted by the Länder and the industry, contributed comprehensive and new data material on the current state of the techniques used in the glass industry in Germany to the exchange of information. In most cases, the ranges of emission levels contained in the BREF accord with the permit practice in Germany. For many member states, the BREF reveals a significant need to catch up in the reduction of emissions of dust and dust constituents containing heavy metals.

BREF for the non-ferrous metals industry

A complete draft BREF has been prepared for the non-ferrous metals industry which is currently being revised following consultations in the TWG. With over 700 pages, this is the most extensive BREF to date, dealing with the production of ten metal groups.

Above all, the section on "emissions into the air" is described in a very well founded way, the sections on "emissions into water", "wastes/residual materials" and "energy" are presented in less detail due to the poor data situation.

The draft describes, inter alia, the use of fabric filters as BAT with emission values for total dust of 1 to 5 mg/m³. For dioxin and furans, a range of less than 0.1 to 0.5 nanograms of international toxicity equivalents per cubic metre (ng TE/m³) are named as the emission level associated with BAT. No separate BAT emission values are given for heavy metals, but reference is made to the low dust emission values. Different techniques and emission values are identified as BAT for SO₂ emissions, dependent on the raw gas concentrations.

Within the framework of a research project of the German-French Institute for Environmental Research of the University of Karlsruhe on behalf of the UBA, and in close cooperation with German industry as well as the Länder authorities, German BAT papers have been produced on state-of-the-art for copper, lead and zinc production and provided to the Seville process. The final report of the research project is planned for publication in the early autumn of the year 2000.

Horizontal BREF on industrial cooling systems

A partial draft has been prepared and is currently being revised following comments from the TWG. The chapters prepared contain detailed descriptions of the techniques applied, selection principles and environmental effects of industrial cooling systems. However, the large number of partly very different and complex cooling systems makes it difficult to describe uniform BAT. Criteria for determining BAT shall be described.

BAT Reference Documents in the Internet

Almost completed draft versions are already ready for the sectors

- Chlorine-alkali industry,
- Ferrous metals processing and
- Tanneries

However, the subsequent consultations in the TWG have yet to take place. The BAT reference documents are already available to the general public via the Internet site of the EIPPCB (<http://eippcb.jrc.es>), in the initial phase as drafts.

Protection of the North Atlantic

To protect the marine environment of the North Atlantic within the framework of the *Oslo-Paris Convention (OSPAR)*, the POINT working group assesses the environmental effects of industrial plants and prepares recommendations or decisions regarding measures for reducing emissions. The POINT work is currently being restructured and in future, should orient itself specifically according to the work on the BAT reference documents. Further POINT activities will be timed so as to be coupled with the publication of the EU BAT reference documents.

The work on the chlorine-alkali industry as well as the non-ferrous metal industry is of great political significance. A workshop on the chlorine-alkali industry was held in Madrid in September 1999, in which, above all, the further work on the PARCOM Decision 90/3 was dealt with in detail. It recommends the phasing-out of the mercury technology, the amalgam process, until the year 2010. An example of available

mercury-free technology is the membrane process. It is becoming increasingly important throughout Europe. At this workshop, three main points were stipulated for the continued work:

- Improvement of the existing chlorine-alkali plant on the basis of technical information (EU-BREFs, UN-ECE protocols)
- Implementation of the phasing-out of the mercury-technology as formulated in PARCOM Dec. 90/3 or discussion of alternative scenarios
- Strategy for the safe handling of mercury in wastes and from plants that have been shut down.

Along with Sweden and Finland, which will change over to mercury-free production before the year 2010 and therefore consider a revision of the agreed date for the phasing-out of the use of mercury for superflows, Germany is also in favour of adhering to the deadline for phasing-out the use of mercury.

The work of POINT (limitation of emissions from point sources) and DIFF (diffuse sources) will in future be combined in a hazardous substances committee which will replace the work level of PRAM (programmes and measures). In this way, more emphasis is to be placed on the implementation of the resolution made at the Ministers' statement of Sintra, Portugal, in the year 1998, to achieve a reduction in the pollutant load in the North Sea to "almost zero" or to natural background values by the year 2020. At the POINT meeting in 1999 therefore, the activities were more strongly oriented to the priority substances on the list of hazardous substances produced by OSPAR in 1998. (III 2.1)

7. Environment and health

In the broadest sense, measures for the protection of the environment also protect health. Measures in both fields often have joint aims and consequently require joint strategies. Work on the complex topic of "environment and health" can only be solved as an across-the-border-task. This work therefore concerns a large number of work units of the Federal Environmental Agency (UBA – see Chapter 8 and 10). In 1999, the Federal Ministry for the Environment and the Federal Ministry of Health jointly introduced the "environment and health action programme". They intended to promote cooperation of those political areas with the aim of a comprehensive study of the consequences for the environment that affect health.

The action programme includes, among others, activities for deepening the understanding of the relationships between environment and health as well as to improve information and communication concerning health risks. One of its important aims is to improve the procedures for risk assessment and standard setting and to make them more transparent. In addition, the programme also names measures for avoiding risks or reducing risks for six priority areas, characterised by special quality targets:

- Outdoor and climate
- Indoor air
- Water resources, soil
- Food – ionising radiation
- Noise
- Materials and preparations.

A coordination group was set up to provide scientific assistance in the implementation of the action programme. The Federal Environmental Agency (UBA), the Federal Institute for Consumer Health Protection and Veterinary Medicine (BgV), the Robert Koch Institute (RKI) and the Federal Agency for Radiation Protection (BfS) are members of this group. The UBA is currently responsible for management of the group.

Further information on the action programme can be obtained from the UBA homepage (<http://www.umweltbundesamt.de>). The UBA has also published a volume of documentation, together with the BgV

and RKI, which presents the current level of progress and knowledge in detail and thus justifies the suggested aims and measures. (// 2.1)

Microbiological risks to human health

"New risk from bacteria", "Pathogens strike back", "Severe toll due to contaminated water", "Plague and cholera on the move", "Fungal spores from the bio bin", "Germs in drinking water", "Woman dies of resistant bacillus", "Fungi in homes on the advance". These were several of the headlines in the past year which draw attention to microbiological risks to human health. Plague and cholera are no longer a danger in Germany due to the high standard of hygiene. Nevertheless, even here we find risks to human health in many fields due to old and "new" pathogens.

Only a few bacteria have developed to new dangerous pathogens by acquiring special properties, such as certain antibiotic-resistant bacteria and pathogenic *E. coli* bacteria (for example EHEC). Most of the new pathogenic organisms, on the other hand, are not really new. They were only unidentified in the past due to a lack of detection methods. This applies to many viruses, *Legionella*, and cryptosporidia.

The introduction of novel technologies in housing areas has also contributed to the emergence of new pathogens (Table 2). *Legionella* and pseudomonades may grow in hot water systems. During composting, fungi occur which may lead to allergic reactions. Certain micro organisms also act as pathogens which were not deemed such in the past or which only caused harmless illnesses. This is due to the growing number of elderly people and of people with a weakened immune system such as AIDS patients or patients undergoing chemotherapy.

The UBA has the task to develop concepts which identify and limit the spread of pathogens along the water, air and soil path including the housing area. In this way, it helps to safeguard human health (see al-

Table 2: New techniques and their undesirable side effects

<i>Technical Development</i>	<i>Problematic Process</i>	<i>Undesirable Consequences</i>
<i>Central water supply</i>	<i>Transport and distribution of pathogens over large distances</i>	<i>Propagation of diseases over long distances (typhoid fever, hepatitis, cryptosporidia, etc.</i>
<i>Central hot water supply</i>	<i>Good growth conditions for certain pathogens</i>	<i>Diseases due to Legionella, pseudomonades, etc.</i>
<i>Mass animal farming</i>	<i>Changed feeding techniques, use of antibiotics</i>	<i>BSE, EHEC, Emergence of antibiotic-resistant bacteria</i>
<i>Composting plant</i>	<i>Creation of large quantities of fungal cultures</i>	<i>Fungal illnesses, Allergic reactions</i>
<i>Change in interior space conditions and construction materials</i>	<i>Favourable growth conditions for mould and bacteria</i>	<i>Allergic reactions</i>
<i>Operation of air conditioning systems</i>	<i>Favourable growth conditions for certain pathogens</i>	<i>Legionellosis, Allergic reactions</i>
<i>Blood transfusions</i>	<i>Transmission of bloodborn pathogens</i>	<i>AIDS Hepatitis</i>

so Chapter 10). To achieve this, the UBA cooperates with other authorities.

Of special importance in the consideration of pathogens is the fact that, opposite to chemical substances, they can reproduce in the human body. In addition, infected people might shed large quantities of pathogens which may reach other humans either directly or indirectly via the water path (wastewater – surface water – drinking water). In this way, one sick person might be the cause of many further illnesses.

People might also be at risk from the uptake of pathogens via the soil path, for example by using compost for growing vegetables. Therefore, it was stipulated in the appendix to the *Biowaste Ordinance*, whose requirements were substantially formulated by the UBA, that during the production of the compost the concentration of pathogens has to be reduced so that the finished product has no harmful effects on humans, animals or plants.

A similar problem arises by spreading untreated sewage sludge on agricultural areas.

Certain bacteria and fungi are transmitted mainly via the air and may lead to adverse reactions in exposed persons. However, only the individual person or groups of people who are directly exposed to the pathogens are affected. There is no risk of further spread of the pathogens, as may be the case in waterborne infections. There are potential risks to human health from airborne microorganisms in many areas: during the collection of biowaste, in the area surrounding composting facilities and animal farming as well as in indoor environments.

Hazards from “natural” triggers

The perception of microbiological risks among the population differs significantly from the perception of risks from toxic substances. Chemical sub-

Table 3: Disease outbreaks in the USA following bathing in contaminated waters

Pathogen	Number of outbreaks	Number of case
<i>Shigella</i>	13	935
<i>E.coli</i>	1	166
<i>Leptospira</i>	2	14
<i>Giardia</i>	4	65
<i>Cryptosporidium</i>	1	418
Norwalk viruses	1	41
Adeno virus 3	1	595
Acute intestinal diseases	11	965

Mortality and Morbidity Weekly Report 1988, 1990, 1991, 1993
Journal of the American Water Works Association 1996

stances are felt to be “non-natural” and therefore more dangerous than microorganisms which are considered to be part of the natural environment. Several microorganisms are clearly known to the population as pathogenic organisms (for example the pathogens causing cholera and typhoid fever). Most of the recently recognised pathogenics are, however, unknown to the population and are therefore not felt to be a threat. At the same time, microbiological risks are always risks of acute illness, while the risks associated with chemical substances in Germany mostly result from longer-term exposure.

Quantitative risk assessment in the evaluation of microbiological parameters is still in its early stages, compared to those for chemical substances. In the following, a short overview of examples of microbiological risks and the possibilities of assessing them is given.

Risks in bathing waters

Bathing waters may contain pathogenic organisms. The main source, apart from the bathers themselves, is wastewater from communities and agriculture. The best prevention against infections is therefore a sustainable protection of the water sources from pollution. Furthermore, a generous offer of bathing opportunities is necessary to prevent overcrowding of individual bathing sites.

Quite a lot has already been done for the prevention of water pollution. However, many bathing waters are

still contaminated by faecal wastewater or are used by too many bathers. Table 3 shows disease outbreaks in the USA after bathing in contaminated waters (such data is not available in Germany, as no such surveys are undertaken). The number of cases per outbreak is usually high, the number of registered outbreaks, however, relatively small. This gives the impression that small outbreaks are identified rarely, single cases not at all. This risk is, therefore, probably underestimated.

How can such a risk be assessed? As the illnesses are caused by swallowing the polluted water, two questions are important for the risk assessment:

- How many pathogenic organisms have to be swallowed for an infection to occur?
- How high is the concentration of pathogenic organisms in bathing waters?

Both questions are difficult to answer. The number of pathogens required for an infection depends on the type of pathogens. Their concentration in the water changes depending on the number of people shedding pathogens. These are both the sick and the carriers, i.e. people who are infected but are not ill.

Despite these difficulties, models for assessing the risk are being developed in the UBA using faecal indicator concentrations (bacteria, which – without being pathogenic organisms – are used as a measure of the faecal contamination of water), which are intended to lead to well reasoned suggestions for limiting values.

Epidemiological investigations are another possible way of determining the risk of infection when bathing. For this purpose, the concentration of the faecal indicators in a body of water is measured on a certain day. During the following days, the percentage of persons who bathed on this day and who became sick is determined. A study from the United Kingdom has shown that even with a relatively low concentration of approx. 40 enterococci/100 ml (equivalent to a \log_{10} of 1.6), the number of bathers suffering from mild diarrhoea increases. The UBA is finding similar investigations in Germany as results from other countries are not necessarily transferable to Germany. Further information is available under <http://www.badegewaesserstudie.de>.

In addition, the UBA carries out its own research on wastewater treatment, *inter alia* with the aim of re-

ducing health risks from bathing. The idea is that minimising the entry of pathogens in bathing waters is the best prevention against illnesses from bathing. Thus, intensive investigations are being carried out to test the suitability of various techniques for waste water treatment for the elimination of pathogens. To this end, both artificial wetlands and highly developed technical microfiltration plants are being investigated.

Risks in drinking water

Pathogens may be spread by drinking water – like by no other medium – to large parts of the population. This is why drinking water epidemics have been always feared. With the identification of their causes more than one hundred years ago, well-aimed and successful measures of combating them were begun. These included treatment and disinfection measures by the water supplier as well as epidemic surveillance by the health authorities.

In more recent times, there have been increasing reports, primarily from Anglo-Saxon countries, about outbreaks of illnesses caused by or associated with drinking water – above all due to “new” pathogens such as cryptosporidia and *Giardia*, pathogenic *E.-coli* bacteria, *campylobacter* species or certain types of virus. In recent years, the attention of the water works, epidemiologists and health authorities has been concentrated on the cryptosporidia, as their dormant forms (oocysts) in drinking water cannot be reliably killed by disinfection measures. In 1994, over 400,000 people were infected with cryptosporidia and became ill, some with severe diarrhoea during what was probably the largest epidemic known to have been caused by drinking water in Milwaukee (USA).

A so-called “action level” of 10 to 30 Oocysts per 100 litres of drinking water was suggested in the USA to prevent such epidemics. In the case of these or higher concentrations being reached, the possibility of an outbreak must be assumed. At lower concentrations, however, the risk should not be ignored. Individual cases of sickness and smaller outbreaks may occur, however, there are not reliably identified by the epidemiological surveys carried out to date. Only at a very low concentration of 0.003 oocysts per 100 litres drinking water is the, purely theoretical, risk considered acceptable according to US cri-

teria (not more than one infection per 10,000 consumers per year may occur to drinking water). Such low concentrations can no longer be checked by measurements. They can only be complied with by taking suitable precautions.

In Germany, waterborne diseases are not registered. Therefore, it is at present not possible to say whether we have a risk of outbreaks caused by new waterborne pathogens being spread by drinking water. Research work carried out by the UBA confirm the wide spread of cryptosporidia in the environment via the water path. These have been detected in resources of drinking water and – in individual cases – in low concentrations in drinking water in Germany too. Therefore a risk assessment is necessary. A system for the epidemiological surveillance of infectious disease should be set up, enabling registration of waterborne diseases.

It is, however, assumed that the risk is low in Germany due to the careful treatment of drinking water according to the multi-barrier system. No special incidences indicating an increased frequency of illness have yet become apparent.

At present, the UBA is preparing a combined research project which will deal with this topic. During this project, epidemiological investigations will be carried out in areas using surface water (in some of which high concentrations of oocysts have been detected in the raw water) and, compared with areas using ground water treatment (low concentration of oocysts, no impairment by agriculture). At the same time, extensive investigations are to be carried out of the raw and drinking water in the same supply areas. The aim is to quantify the risk at very low concentrations of parasites in drinking water.

Risks from airborne microorganisms in outdoor air

During composting, biological processes take place which may lead to a massive release of microorganisms and thus to a potential risk for human health. These processes are, however, not damaging to health *per se*. They are, in fact, natural processes in which an organic substance is degraded by microorganisms which include among others, moulds. Similar processes also take place in forest soil. The problem in large-scale commercial composting rather de-

rives from the very large quantities of organic substance that are converted in one place. An increased quantity of released microorganisms and microbial metabolism products are therefore to be expected. These greatly increased concentrations may have adverse health effects, above all in the form of allergic reactions.

However, there is too little knowledge available to be able to correlate the concentration of microorganisms to the risk of an allergic illness. Therefore, a quantitative risk assessment, as described for bathing waters or drinking water, is not yet possible. Instead, a comparison with ambient air is made to assess the risk. The greater the distance from a composting plant, the lower the concentration of microorganisms and substances released by the plant. From a certain distance, background concentrations will be reached. The influence of the plant is thus no longer relevant compared to the naturally present concentrations. Possible health risks due to the composting plant definitely no longer exist.

At a conference organised by the UBA in autumn 1999, the latest results of research projects dealing with the spread of microorganisms in the area surrounding composting plants were presented. It became clear that from a distance of 200 to 500 metres from the plant, depending on the type of plant, background values were reached and thus an influence of the plant was no longer able to be determined. Under certain meteorological and topographical circumstances, however, more far reaching influences have been measured. This means that the assessment of the risks caused by a composting plant on the nearby population must also consider local circumstances.

The results of this and of other research projects still underway will enable recommendations to be produced for the construction of composting plants with the aim of minimising health risks for the population. Indoor air of livestock confinement houses also contains a large number of microorganisms which reach the area surrounding the stables through the waste air. Thus, similar problems arise for the neighbourhood of a large-scale livestock farming plant as for a composting plant.

The UBA is currently investigating the concentration of airborne bacteria and fungi in the area surround-

ing open storage containers for liquid manure in agriculture, to be able to better record the health risk for humans, who live in the immediate and close vicinity of such storage containers. The initial results of the study indicate that it must be expected that germs are spread to the ambient air during certain weather conditions.

Health risks of indoor air

Due to the thermal insulation requirements for new buildings the free exchange of air between indoor environments and ambient air has been consciously reduced as far as possible, to avoid energy losses through the brickwork, drafty windows and doors, etc. With the *Energy Conservation Act* from 2000 this will be of increasing importance even in the renovation of existing buildings. The UBA supports this policy of energy conservation.

The disadvantage is, however, that moisture generated during the stay of persons in the room – if the room is not adequately ventilated – cannot be sufficiently fed to the outside. This may lead to moisture damage in homes. Damage caused by moisture is also caused – to the same extent in all types of buildings – by construction faults where moisture in walls and ceilings penetrates through cracks in the brickwork, leaking utility pipes, etc. directly into the building material or where condensation forms on cold wall surfaces. As a result of this damage due to dampness, fungi may grow in the accommodation. Inadequately constructed or badly maintained air-conditioning device can also be a source for fungi and other microorganisms.

Fungi release spores and metabolic products (Microbiological Volatile Organic Compounds, MVOC, and mycotoxines) into indoor air which may impair health. To detect contamination by fungi, comparison is made with the ambient air. A concentration of fungi in indoor air of 100 CFU/m³ (CFU=Colony-Forming Units) above the outdoor air is regarded as detection of a fungal source in the indoor environment. Contamination with toxin-forming or pathogenic fungi is particularly critical as these can cause not only allergies, but also other impairments to health (headaches, tiredness, impaired immune defences) and infections (mycoses). Moulds found in nature colonising plants are less problematic.

Further research is necessary to determine the true health risk for residents caused by fungi and bacteria in private homes. A great problem is the lack of a uniform detection method for measuring contamination by fungi in indoor environments.

Apart from this, the recommended measure to prevent fungal growth is to regularly ventilate rooms with thermal insulation thoroughly, but only for short periods of time. In this case, the resulting energy losses are kept low.

Outlook

The last quarter century has seen the occurrence of previously unknown infectious diseases, *inter alia* AIDS, BSE, legionellosis and EHEC infections. Especially the latter have alarmed those responsible for water hygiene, because the pathogens causing this – potentially lethal – disease are nothing more than modified strains of the usually harmless intestinal resident *E.coli*. In view of the infection route of these diseases, via water, it is easy to imagine an easy change in the infection conditions (say an increased shedding or a lower infectious dose) resulting in alarming scenarios.

This results in the necessity for increased awareness in water management, in bathing waters and pool water hygiene, as well as in the areas of air hygiene, where pathogens may occur and spread. It is necessary to apply current knowledge in epidemiology and infectiology quickly and precisely, to identify dangerous developments without delay, to quantify risks and to minimize them by precautionary measures.

(II 2.3, II 2.4, II 4.6)

8. The effects of noise

The effects of noise can impair living conditions in many different ways. Every audible sound that causes or leads to a nuisance, to disturbance or to risks to health is called noise.

The *Federal Immission Control Act (BImSchG)* aims to avoid health hazards and considerable nuisance due to noise. However, the BImSchG does not define the terms “considerable nuisance” and “health hazard” in practical terms. Research into the effects of noise has produced fundamental principles though.

The main effects of environmental noise include nuisances. Above all, they are caused by disruptions to communication, rest and relaxation, including sleep, and impair people’s well-being.

To define the term “considerable nuisance” more precisely, interviews held in a series of interdisciplinary field studies were used to determine the relationship between noise exposure and its effects on awake and sleeping people. The studies use dose-response curves to make the relationship between noise exposure and impairment transparent and provide values for noise exposure, above which impairments are to be expected (Table 4).

Depending on the time of day, (day/night) noise triggers different reactions to different extents. In general, no appreciable impairment is to be ex-

pected when equivalent continuous sound levels (L_m) within dwellings are below 25 dB (A) at night and below 35 dB (A) during the day. These conditions are achieved if, with windows tilted open, the outdoor level is less than 40 dB (A) at night and less than 50 dB (A) during the day. During the day, if the equivalent continuous sound levels are above 55 dB (A) outside of the house, increasing impairment of psychological and social well-being is to be expected.

Disturbed sleep due to noise can be mostly avoided if the equivalent continuous sound level in bedrooms does not exceed 30 dB (A) and individual sounds do not exceed 45 dB (A).

Continuous loud environmental noise can also lead to health damage in addition to causing a mere nuisance. Noise causes unspecific stress reactions. People who are awake react to high noise levels directly, or, in the case of noise nuisances, indirectly, with increased release of different stress hormones. During sleep, exposure to substantially lower noise levels leads to increased release of stress hormones. Here, the normal fluctuation is exceeded in part, and in the long term, increased excretion of cortisol is observed. Initial results from the field investigations into the long-term influence of exposure to road traffic noise on the excretion of stress hormones release are now available: In comparison with a control group living in quiet conditions ($L_m < 45$ dB (A) at night), the excretion of noradrenaline and cortisol in the group exposed to traffic noise ($L_m = 53$ to 69 dB (A) at night) was significantly increased. The findings give reason to fear that noise can cause increased risks for cardio-vascular, gastrointestinal and immune system disorders.

Epidemiological studies to date have focused almost exclusively on the relationship between traffic noise and heart attacks. They consistently revealed a tendency of an increased risk at exposure levels above 65 to 70 dB (A) (L_m daytime, outside of the dwellings) when day-time exposure to road traffic noise exceeds $L_m = 65$ dB (A), an increase in heart attack risk of approx. 20 % is to be expected.

Table 4: Reference values for avoiding nuisances

Daytime L_m /dB(A)	Night-time L_m /dB(A)	Comments
< 50	< 40	Outside the building
< 35	< 25	Inside the building

L_m = Equivalent continuous sound pressure level, dB(A) = decibel

Table 5: Calculated noise exposure of the population (old Länder – former West Germany) due to noise from road and rail traffic

Equivalent continuous sound exposure level [dB(A)]	Proportion of the population (%) affected by			
	Road traffic in 1999		Rail traffic in 1997	
	Daytime	Night-time	Daytime	Night-time
> 45 - 50	16.4	17.6	12.4	15.5
> 50 - 55	15.8	14.3	14.9	10.8
> 55 - 60	18.0	9.3	10.4	6.2
> 60 - 65	15.3	4.2	6.2	2.7
> 65 - 70	9.0	2.9	2.3	0.9
> 70 - 75	5.1	0.2	0.7	0.4
> 75	1.5	0.0	0.1	0.1

Traffic noise pollution

The dominant sound source for the largest part of the population is road traffic.

According to calculations of the UBA (Federal Environmental Agency), almost half the population of Germany is exposed to road traffic noise level at which damage to physical and social well-being is to be expected (L_m over 55 dB (A) daytime). For rail traffic, the proportion is approx. 20 %. 15.6 % of the population are affected by road traffic noise levels at which there are an increased risk of cardiovascular diseases ($L_m > 65$ dB (A) daytime), and 3.1 % are subjected to the same risk from rail traffic.

Even at night, noise pollution is high in many places. Around half the population is exposed to road traffic noise levels ($L_m > 45$ dB(A)), at which impairment to sleep must be expected if the windows are opened. For rail traffic, the proportion is approx. 37 % (Table 5).

The *Traffic Noise Ordinance – 16th BImSchV* dated 12th June 1990 lays down exposure limit values designed to protect the neighbourhood against harmful environmental effects caused by traffic noise (noise precaution) for noise protection due to the construction of new roads, or significant changes to public roads, as well as railways and tramways (Table 6).

There are no limiting values for protection against noise from existing traffic routes (noise remediation) and therefore no legal rights to noise remediation. Noise remediation measures are carried out here

based on budgetary regulations if the rating level exceeds the guideline value for noise remediation. The values in Table 6 apply to federal traffic routes. From 1978 to 1998, 1.26 billion DM were spent on noise remediation on federal trunk roads. Noise remediation on railways was not started until 1999, whereby a long-standing recommendation of the UBA is finally being realised. Initially, 100 million DM per annum are available for these measures.

The UBA – alongside many other institutions – has repeatedly advocated statutory regulation of noise remediation. The Federal Government has heeded this advice and has identified this statutory regulation as a task for the current legislative period. For health protection reasons (increase in the risk of heart attack) in the first stage a rating level of 65 dB (A) during the day and 55 dB (A) at night should not

Table 6: Limit and guide values for protection against noise from traffic routes

	Precaution*		Remediation**	
	Daytime	Night-time	Daytime	Night-time
Hospitals and similar	57	47	70	60
Residential areas	59	49	70	60
Mixed-use areas	64	54	72	62
Commercial areas	69	59	75	65

* New or significantly altered roads and railways

** Roads and rail construction financed by the Federal government (In accordance to existing funds)

Target values of the Federal Environmental Agency (UBA):
65/55 dB(A) daytime/night-time for residential areas

**Table 7: Noise emission limit values for motor vehicles
 (without specification of changes in measuring methods)**

Vehicle category	Driving noise limit value in dB (A)				Criteria for low-noise motor vehicles Noise limit value Pursuant to Appendix XXI StVZO (1.12.1984)
	Until 1980 (Directive 70/157/EEC)	Until 1988 (Directive 81/334/EEC)	From 1988 (Directive 84/424/EEC)	From 1995 (Directive 92/97/EEC)**	
Car	82	80	77	74	
Transporter, minibus					
< 2.0 t	84	81	78*	76	
> 2.0 - 3.5 t	84	81	79*	77	
Bus > 3.5 t					
> 3.5t; < 150 kW	89	82	80	78	
> 3.5t; > 150 kW	91	85	83	80	
Lorry					Lorry > 2.8 t
> 3.5t; < 75 kW	89	86	81*	77	77
> 3.5t; 75 - < 150 kW	89	86	83*	78	78
> 3.5t; > 150 kW	91	86	84*	80	80
	Until 1980 StVZO	Until 1988 (Directive 78/1015/EEC)	Directive 87/56/EEC Valid from 10/88	Valid from 10/93	
Motorcycles					
< 80 cm ³	84	78	77	75	
< 125 cm ³	84	80	79*	77*	
< 175 cm ³	84				
< 350 cm ³	84	83	82	80	
< 500 cm ³	84	85			
> 500 cm ³	84	86			

Source: Federal Environmental Agency: "Was Sie schon immer über Autos und Umwelt wissen wollten" (1996)
 * Came into force 1 year later
 StVZO = German Road Traffic Licensing Regulations
 ** Supplement of 1dB(A) for series production vehicles

be exceeded. The UBA has submitted suggestions for the realisation of this target within 10 years. The results of a symposium on this topic have been published.

Noise reduction in road traffic

Noise pollution from road traffic is primarily determined by the vehicles mileage, vehicles emission and driving style (above all with respect to speed and engine speed). Other important influencing variables are the combination tyres/road surface as well as the geometric conditions of the sound propagation, i.e. location of the source and the receptor and shielding.

A significant reduction in noise pollution can only be achieved by a large number of mutually harmonised individual measures – from motor vehicle engineering to traffic planning and motor vehicle taxation laws.

The spectrum of traffic planning measures for reducing road traffic noise is very broad. In a broader sense, it also includes urban planning measures ("the pedestrian and cyclist-friendly town of short distances"), road traffic law (for example: 30 km/h speed limit, parking management and restrictions for motorised private transport) as well as pricing policy elements (fuel taxation, heavy goods levies). Locally, these measures can achieve reductions of up to 10 dB (A) even in the short-term; in general, the

potential is estimated at around 3 dB (A), which equates to halving traffic volume. Apart from traffic planning measures, measures at “source” – i.e. for reducing the noise emissions of individual vehicles – are particularly important in an overall concept for noise reduction in road traffic. These have a universal effect and in this respect have priority over secondary noise protection methods such as noise barriers or soundproof windows, which merely have a local effect.

Measures for reducing the noise emissions from motor vehicles are aimed at making vehicles, road surfaces and driving. The EC Directives which have been incorporated in the *Road Traffic Licensing Regulations (StVZO)*, stipulate measuring techniques and emission limit values for vehicle noise (maximum pass-by level at a distance of 7.5 m) in individual vehicle categories. In the 80’s, the emission limit values for cars, lorries and buses were reduced in several stages. The last reduction has been applicable for all new vehicles since October 1996. Since then, there is no longer a road vehicle category with a limit value above 80 dB (A) (Table 7).

However, in actual traffic the stricter noise limit values have not had the same effect, as they only apply to newly registered vehicles. Old vehicles dilute the desired effect as long as they are still in circulation. Also, the driving and operating conditions determined in the vehicle type approval procedure techniques increasingly deviate from the overriding conditions in actual traffic, due to changes in vehicle technology (increased engine power) and increased traffic volume.

Therefore, current efforts with respect to reducing the noise emissions from vehicles are focussed on

- Improving the noise regulations for motor vehicles (more realistic type testing methods with more ambitious noise emission limit values)
- Improved control of compliance with the noise regulations over the whole lifetime of a motor vehicle
- Introduction of binding, ambitious EU noise limit values for all tyres sold
- Introduction of ambitious noise emission requirements for road surfaces which should at least be applied to the resurfacing of noisy roads
- Development of strategies for action against motorcycle noise (influencing driving behaviour, pre-

venting unauthorised loud silencers, solutions for so-called problem routes).

Environmental labelling for car tyres

In addition to the planned EU noise limit values for tyres, existing potential for reductions with respect to noise and fuel consumption can be utilised at an early date. To create the highest possible incentive for tyre manufacturers to develop low-noise and low rolling resistance tyres, the UBA, together with representatives of the tyre industry, have developed the terms of award of the “Blue Angel” environmental label – initially for car tyres.

Investigations on 48 types of tyres resulted in 9 types complying with all the criteria of the environmental label (“because low-noise and fuel-saving”) with the exception of the lifetime which was not determined. There were no conflicts in aims between the environmental and safety criteria.

Noise reduction in rail transport

In the case of the otherwise comparatively environmentally friendly rail, noise is the most serious environmental problem. It is increasingly becoming the obstacle to development of the rail network, and puts at risk the aim of transferring more traffic from the road to rail. The reduction measures developed recently could significantly reduce impairment due to rail traffic noise, even in the short term: They aim to reduce rolling noise, which is the dominant source of noise at usual speeds with the philosophy “smooth wheel on smooth tracks”:

- Acoustically optimised grinding of the rails enables noise reductions of 3 dB (A) and more to be achieved for trains with smooth wheels compared to an average, good track condition. This equates to halving the traffic volume.
- Replacement of the cast iron blocks which are found in the brakes of all goods wagons and several regional transport wagons with composite blocks prevents roughening of the wheel surface and thus reduces the noise emissions by up to 8 dB (A) compared to vehicles with cast iron blocks.

Even in the other types of rail vehicles, other vehicle models have been developed that are significantly quieter than average. Figure 6 shows the range of

noise emissions from vehicles in use today. The quiet vehicles have been presented at several UBA events, most recently at an expert discussion on noise emissions from regional rail passenger transport in June 1999. In the long-term, emissions are to be aimed for which are achieved with the prototype of the "quiet goods wagon" of the German, Italian, and Austrian railways.

Because there is no noise regulation for rail vehicles to date, noise protection measures in rail transport – unlike road vehicles – have only been inadequately implemented until now. The UBA has therefore had suggestions for such a regulation developed. In the meantime, the European Union is also paying more attention to the problem of rail traffic noise. In December 1999, it set up a working group on this topic, in which the UBA will contribute the limitation of noise emissions as the most important measure.

The Deutsche Bahn AG is now implementing acoustically optimised rail grinding in the form of the "particularly monitored track". At the end of 1999, the

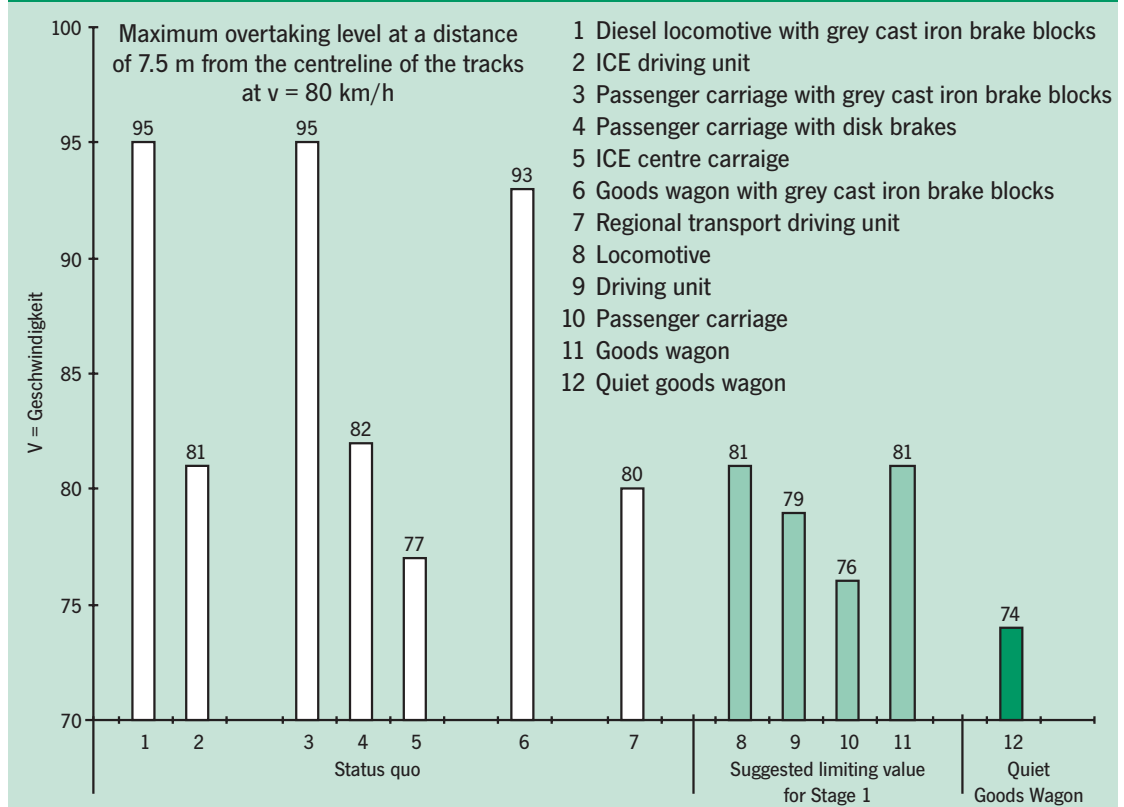
UBA suggested procedures for monitoring the rail condition, which are suitable for ensuring long-term protection of residents.

Since 1999, the Federal Government has provided 100 million DM per annum for noise remediation along its rail routes. The UBA has suggested that these funds be used to finance not only noise protection panels and walls but also acoustically optimised rail grinding and the conversion from cast iron blocks to composite blocks. While inexpensive rail grinding is now being used as a measure, the conversion of the vehicles has not yet been included in the programme. Therefore, for the time being the high potential for achieving reduction by vehicle conversion and by the combined effect of smooth wheel on smooth rail in goods traffic remains unused.

Protection against aircraft noise

The Federal Government intends amending the *Air Traffic Noise Act* of 1971 during the current legisla-

Figure 6: Status quo and proposed limiting values for railroad vehicles



tive period. The UBA has produced detailed suggestions as part of the preparation work. In the opinion of the UBA, the amendment to the law should consist – as the original version – of two divisions. In the first section, the criteria by which noise protection zones are to be determined will be rewritten. The second section should contain various other environment-related regulations, such as the regular publication of data measured by the aircraft noise monitoring systems.

In particular, for the amendment of the Air Traffic Noise Act, an extension of the scope of the act to include numerous other airfields and an adaptation of the aircraft noise assessment methods to methods used for road and rail traffic noise have been suggested. Thus, in future, the calculation of noise protection zones should be carried out by the separate determination of equivalent continuous sound levels for day and night. In addition, frequency/maximum level criteria could be introduced for night time (22.00 to 06.00 hrs).

To evaluate the effects of the amendment suggestions, extensive sample calculations were carried out for various civil and military airports and airfields. They show that it is not possible to make a generalized statement about the form and size of the noise protection zones according to the amended law, because aircraft operations at the individual airports and airfields differ too much.

The calculations for the civil airports show that – depending on the traffic volume, the aircraft used and the extent of night flying operations – completely different constellations are obtained. It depends very much on the individual case.

At the military airfields or air/ground firing ranges, significantly larger noise protection zones result that according to the current law.

In addition, investigations were carried out on the effects of the amendment with respect to costs for airport operators, which fall within the scope of the current law. At the same time, it was assumed that in the new protection zone 1 and in the night protection zone, sound insulation windows would have to be installed at the expense of the airport operator. In addition, it was to be taken into account that bedrooms in the night protection zone were to be fitted with ventilation facilities.

Limit values of 65 dB (A) (civil airports) and 68 dB (A) (military airfields) were assumed for the new protection zone 1 in the cost estimate. A uniform limiting value of 50dB(A) was used for the night protection zone.

The UBA calculated one-off costs for German commercial airports of approximately 366 million DM. The costs for the military airfields and air/ground firing ranges are estimated at approx. 455 million DM. The work for the amendment of the Air Traffic Noise Act is currently being continued with extensive investigations for smaller airfields. (I 3.5)

9. Dust – the underestimated danger

In 1964, as in Germany an immission value was stipulated for dust for the first time, its potential damage to human health was unclear.

Even today, there are still many gaps in our knowledge about the effect of dust on health. These finely distributed solid or liquid suspended materials which

occur in the atmosphere as aerosols, vary considerably both in their chemical composition and their grain size.

Inhaled particles with a diameter of more than 10 micrometres (μm = 1 thousandth of a millimetre) are mostly discharged in the nasal-pharynx. This also applies to 60 to 80 percent for dust particles with a diameter of 5 to 10 μm . Very fine dust particles (smaller than 0.1 μm) on the other hand, end up very deep in the respiratory tract and are discharged by diffusion. Their main constituents are shown in Figures 7 and 8.

Epidemiological studies show clear positive relationships between particle emissions and impairments to the respiratory tracts and premature mortality. However, whether the mass or the number of the particles, their surface property or the chemical composition plays the decisive role, is still disputed. The exposure time has a significant influence. It is certain that the grain size is very important for the possible effects: The smaller the particles are, the further they can penetrate via the mouth or nose, windpipes and bronchioles into the area of the pulmonary alveolus and, once there, unfold their damaging effects.

The effect of the suspended dust on the respiratory tracts and the cardio-vascular system obviously increases with decreasing particle size: In general, smaller particles have more serious consequences. During the course of the epidemiological studies which above all were carried out in the USA and Europe, one aspect in particular became ever clearer. Apparently, it is not possible to set a threshold value for the concentration of fine dust in air below which no further effects are to be expected. Investigations by the Institute for Epidemiology of the GSF Research Centre for the Environment and Health, Neuherberg near Munich, show that ultra fine particles with diameters less than 0.1 μm are accompanied by impairments to health.

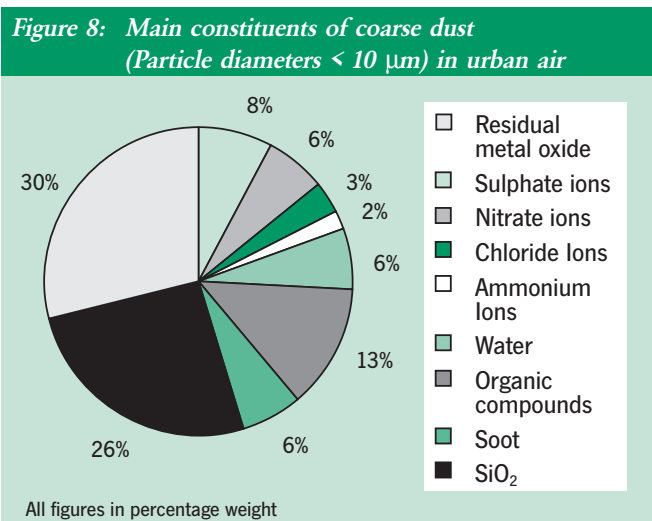
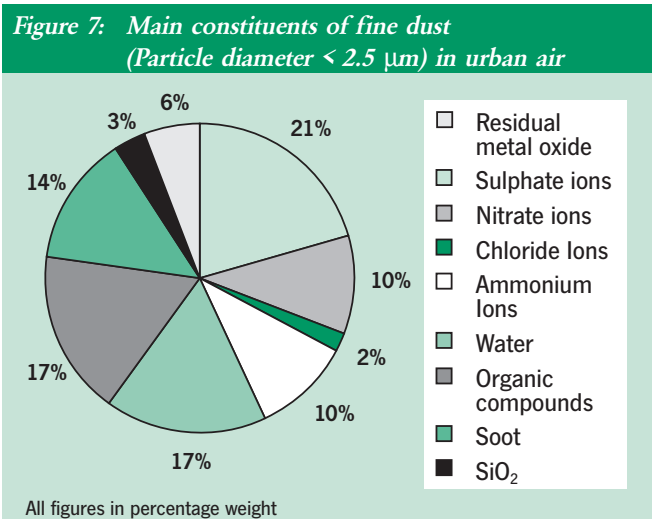
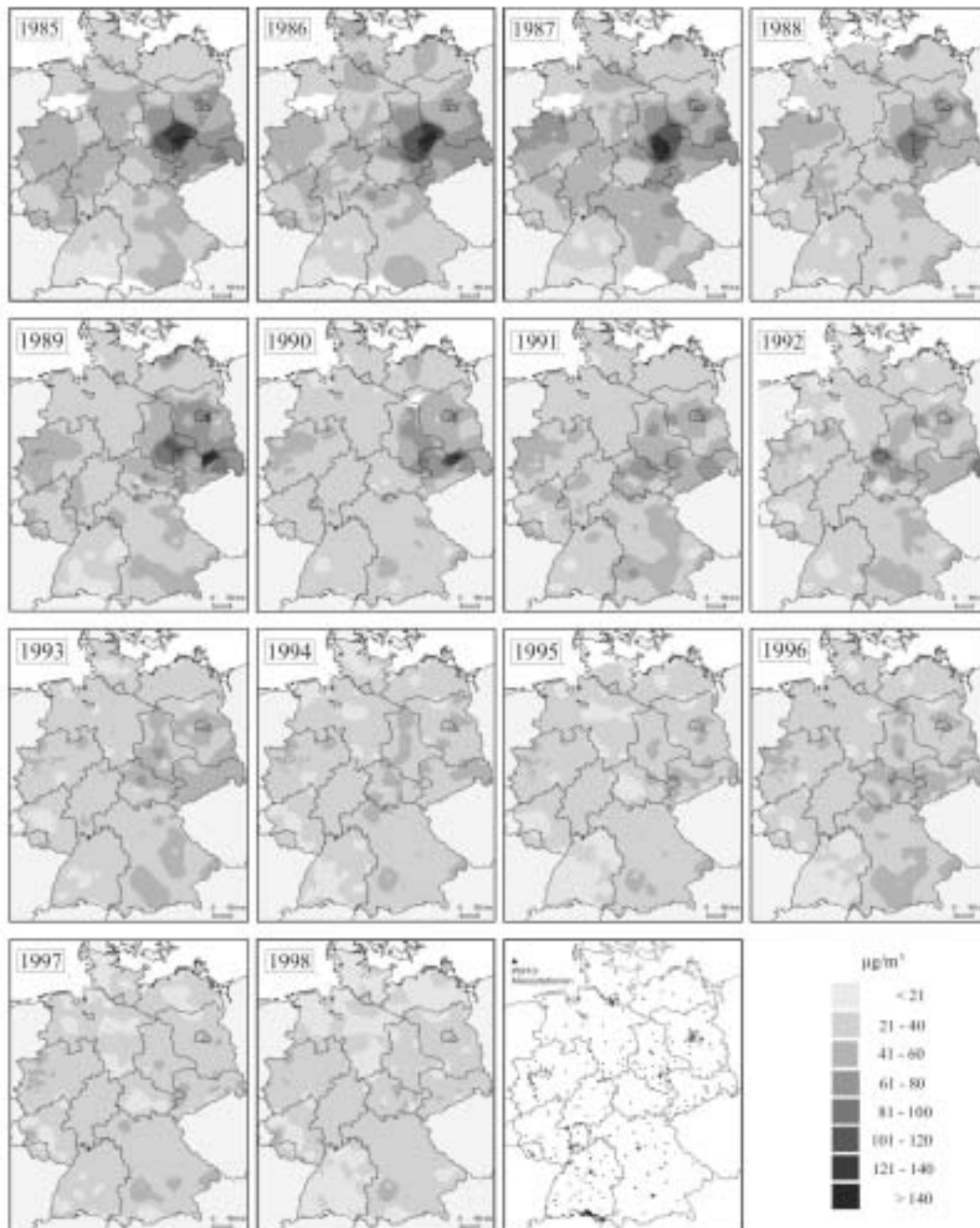


Figure 9: PM_{10} annual average values 1985–1998 in Germany

Converted from suspended dust using the factor 0.83: class amplitude $20 \mu\text{g}/\text{m}^3$



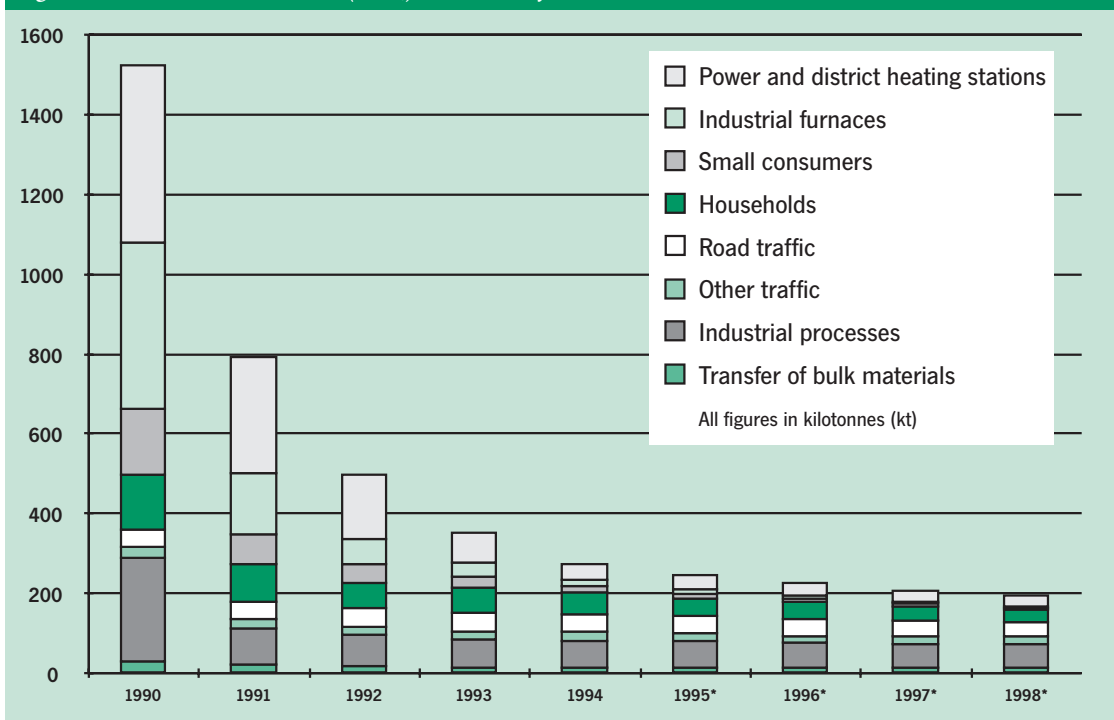
Data: Measurement network of the Länder (States) and the Federal Environmental Agency

Due to the interpolation method used,
 interpretations for smaller areas are not permissible

$\mu\text{g}/\text{m}^3$ = microgram / cubic metre

UBA II 6.4

Figure 10: Fine dust emissions (PM_{10}) in Germany 1990 to 1998



Research is required into the question as to which particle properties are decisive for the effect. At the same time, it is perfectly feasible that it is not possible to provide a uniform statement for all effects. The measures required to reduce dust loads with respect to health and the measured variables which are suitable for monitoring them depends significantly on the answer to this question.

In accordance with the findings on the effects, particle immissions in the EU were limited to a grain size of less than $10 \mu\text{m}$ (PM_{10}) in the *Directive on Limiting Values for Sulphur Dioxide, Nitrogen Oxide and Nitrogen Oxides, Particles and Lead in Air (1999/30/EC)* (see also Chapter 13).

Different to the USA, where the smaller particle fraction was limited to particle diameters of less than $2.5 \mu\text{m}$, in Europe the data situation for determining limiting immission values for particles with smaller aerodynamic diameters is not yet deemed adequate.

The limiting immissions value for dust of PM_{10} can hardly be monitored in Germany at present as the immissions measuring networks are mostly not suitable for this purpose and will have to be reequipped.

In the meantime, an impression of the PM_{10} concentration in Germany can be gained if the traditionally measured dust concentration is converted to PM_{10} using the factor 0.83. This results in the development for Germany identifiable in Figure 9.

Limiting values for immissions

Limiting values for dust immissions were introduced in Germany in 1964 with the *Technical Instruction (TA) on Air Quality*. Initially, only the dust deposit was recorded. Then in 1974, the concentration of the suspended dust was limited for the first time – namely for dust particles with a diameter smaller than $2.5 \mu\text{m}$, in today's jargon: $PM_{2.5}$. The 1986 amendment to TA Air retained these immission values.

The limiting values of the applicable *EC Directive 80/779/EEC* are 300 micrograms per cubic metre air ($\mu\text{g}/\text{m}^3$) as the 24-hour average and $150 \mu\text{g}/\text{m}^3$ as the annual average.

The smog ordinances of the Länder – where still in force – have provided threshold values for sulphur dioxide plus dust concentrations since around 1985.

During the same period, the requirements for the limitation of particle emissions have been raised on several occasions, according to the respective state-of-the-art. Today, for defined, recorded sources highly effective dust separators, such as fibrous filters, electric filters or high performance wet separators are used for practically every type of plant. This has resulted in the particle emissions falling since 1985. However, reliable data on dust emissions are only available from 1990 (Figure 10).

Effects of dust

What is the potential damage of this dust load, what are the most important causes of the load, how will this load develop in coming years and where does the most important need for research lie?

Ultimately, depending on the situation, different properties of the dust will probably be responsible for its health-damaging effect. As a basis for measures to achieve the targets, the most integrating, if necessary comprehensive assessment methods are suitable.

In cost-benefit considerations, the costs can be relatively well estimated. Determination of the benefit and its monetary evaluation are, however, difficult.

Using an approach developed in Switzerland, it has been calculated that the number of deaths due to air pollution caused by traffic is around three times the number killed in traffic accidents. Here, the data for the risk caused by dust determined in cohort studies was directly used as rates of increase for the annual mortality. Many methodical arguments can be raised against this approach, which allow the conclusion that the number of deaths due to traffic emissions is overestimated (probably by a factor of around 5).

The question whether particulate air pollution causes cancer, is increasingly concentrated on the proportion of insoluble or low soluble smaller solid particles in fine dust dependent on the exposure situation. Based on the discussion on diesel soot, in the meantime particles with comparable structural characteristics as Otto engine particles or coal dust fall in the same category of effect consideration.

Two more recent epidemiological studies support the assumption that there is an increased risk of lung

cancer at workplaces polluted by diesel exhausts. Several German epidemiologists evaluate this as a clear indication of a lung cancer producing effect of diesel exhaust in cases of occupational exposure.

Although an increased risk of lung cancer from particles in coal mining has not yet been consistently proved, more recent metastudies on this topic suggest a distortion in the follow-up mining studies, which could indicate a systematic underestimation of the risk. Two more recent epidemiological studies indicate that there is an increased risk of lung cancer in coal miners.

Risks in animal experiments

In the lungs of rats, diesel soot and other particles without specific toxicity lead to increased risk of lung tumours as a result of long-term exposure and high concentrations. This has not been clearly determined with other test animals.

Direct gene toxicity from extracted diesel soot and other particles without specific toxicity has not yet been clearly proven. However, there are clear indications for "indirect" gene toxicity via stimulation of the inflammatory cells.

Numerous authors see inflammation processes, increased cell proliferation as well as hyperplasia and metaplasia as important prerequisites for the formation of tumours in rats.

Effects on the climate

Aerosols also have an effect on the climate. However, the spatial relationship must be considered more at regional level or covering a wide area and less on a global scale.

A differentiation must be made between a direct and an indirect effect: The direct effect is based on the fact that aerosol particles have the property of dispersing visible light. As a result, less light and less energy reaches the surface of the earth, thus reducing the temperature. This effect of the aerosols is obviously contrary to the greenhouse effect.

An indirect effect is that aerosol particles form condensation nuclei for cloud droplets. An increase in

Table 8: Dust emissions, 1996 in Germany*, Estimate

Source of the dust/ type of plant or source	Total dust 1996 [kt]	Proportion of fine dust [%]	Fine dust [kt]	Proportion of total fine dust 1996 [%]
Industrial processes	103	60 ³⁾	61.8	32.5
Power and district heating works	33	95	31.4	16.5
Industrial furnaces	7	95	6.7	3.5
Households**	16	90	14.4	7.6
Small consumers***	7		6.3	3.3
Bulk goods transport	47	20	9.4	4.9
Road traffic (exhaust)	41	100	41	21.6
Remaining traffic	19	100	19	10
Total	273		190	100

kt = kilotonnes

* Primary dust emissions (formation of secondary aerosols from precursor substances not included)

** Plant for which the 1st BImSchV applies (Reference year 1995)

*** 60 % is an aggregate dimension from: 90 to 100 % fine dust proportion at recorded point sources with effective separators, approx. 80 % for partially recorded and cleaned waste gas flows and approx. 30 % of diffuse process emissions without waste gas cleansing

the particle density results in the formation of a larger number of – albeit smaller – cloud droplets. As a result, the optical properties are altered, the cloud appears lighter and reflects the visible radiation of the sun more strongly than for a lower droplet density. This is also a cooling effect.

While the direct effect is fairly well quantifiable, the indirect effects are associated with large uncertainties.

The most important sources of aerosols that have an effect over a large area are

- sulphur dioxide (SO₂) as the precursor of sulphate particles from industrial or domestic com-

bustion processes caused by humans, including traffic;

- forest fires (e.g. in the tropics),
- Wind turbulence, as in Sahara dust, as well as
- industrial dust emissions.

As the sources are not evenly distributed and the retention period of the aerosol particles in the air is limited to around a week, the aerosols primarily have a regional effect (Europe, North America, East Asia). Here the greenhouse effect is concealed, in some places considerably.

Sources of dust formation

Considerable quantities of dust can be released from many industrial processes. In particular, in thermal processes in furnaces, gas, petrol and diesel engines, the proportion of fine dust can be very high. The significant primary anthropogenous dust emission sources as well as their fine dust contribution are given in Table 8.

The main sources of dust are industrial production processes followed by traffic, the power stations, industrial furnaces as well as small furnaces. In the industrial processes, most of the dust emissions stem from the plants of the metal producing and processing industry, followed by the stone and earth industry (Table 9).

Table 9: Fine dust emissions from industrial processes

Industrial Process	Fine dust emission [t/a]
Steel, iron, metals including processing	approx. 35,900
Stones, earth, glass, ceramics, construction materials	approx. 13,500
Mining	approx. 4,800
Chemical industry	approx. 4,100
Timber, pulp	approx. 2,300
Food, luxury food and feed	approx. 800
Recycling and disposal of waste	approx. 400
Total	approx. 61,800

t/a = tonnes per annum

In particular, the source groups close to the ground, such as traffic and small and household furnaces as well as diverse commercial sources, have a significant influence on the fine dust emission. In cities, traffic plays the dominant role.

In addition, there are other primary dust sources which can make quite a significant contribution to immission loading. For example:

- Agriculture, especially due to dust formed during the wheat harvest
- Pumice mining
- Dust from stone quarries
- Work on buildings (jetting works)
- Redistribution of settled dust by wind and fires.

In addition, there are natural sources:

- Oceans (a part of sea salt is fine dust)
- Volcanoes (no practical significance in Germany)
- Biogenic particles such as spores, pollen, bacteria, viruses
- A significant portion of particles with diameters less than $0.01 \mu\text{m}$ is emitted from soils – contrary to earlier assumptions.

Significant polluter: traffic

In Germany, dust emissions from traffic accounts for less than 10 percent of the total dust mass of dust emissions. However, emissions caused by traffic have a much stronger influence on the suspended dust concentration in the immediate environment of humans than say power station emissions. The reason: In conurbations they are released in the immediate vicinity of the population. The traffic is also one of the most important sources of emissions of elementary carbon (diesel soot) and $\text{PM}_{2.5}$.

Based on a research project, the emissions from traffic caused by tyre attrition are estimated at approx. 73 kt (kilotonnes; fine dust proportion 7.3 kt).

As already explained, it is suspected that diesel engines emit carcinogenic particles. In particular, older diesel engines produce large quantities of these particles per kilometre driven.

One solution to this problem is the introduction of particle filters. Systems tried and tested in practice have been available on the market for years both for utility vehicles and construction machines and in var-

ious designs and are even almost ready for mass production for cars. A French car company is the first to announce the introduction of a diesel car with particle filters as a standard fitting for cars licensed in 2000. Particle filters have a high separation rate of well over 90 % – even for the finest particles – and could be realised in the series production of diesel cars with costs of several hundred DM each.

Whether and when this technology is actually built in series to a large extent depends on other technical developments. The EURO III limiting values for the year 2000 can be achieved for cars and utility vehicles without particle filters. The EURO IV limiting values from 2005 contain a particle reduction of approx. 70 % compared to EURO II together with a NO_x reduction in the same order for diesel cars. However, it is left to the manufacturers to decide what technology they use to achieve these values.

Particle filters are only one possible variant which will probably be used for medium and heavy cars. The EURO IV limiting values for utility vehicles from 2005, however, are likely to generally require the use of particle filters.

With the implementation of the limiting value stages EURO III to EURO IV, the feared potential carcinogenic effect of the diesel exhaust will be drastically reduced. If one sets the cancer producing potential of the diesel car emissions of the 80's at 100 percent, the risk due to the already applicable and yet to follow exhaust gas reduction stages for cars, even without particle filters, will be lowered to only 11 percent. The use of particle filters would in fact further reduce the carcinogenic potential by 1.4 percent of the starting situation.

A comparison between the diesel engine and spark ignition engine shows: The carcinogenic potential of the spark emission engine's emissions lies at least a factor of 10 lower than for comparable diesel cars, both for EURO II and III as well as for EURO IV. Only the introduction of particle filters will enable the particle emissions per kilometre driven and thus the carcinogenic effect to be reduced to a low level comparable with that of the ignition spark engine.

At the beginning of August 1999, the Federal Environment Minister, Jürgen Trittin, and the President of the Federal Environmental Agency, Prof Andreas Troge, therefore publicly spoke out in favour of intro-

ducing particle filters for diesel engines or an equivalent technology, not only for heavy utility vehicles, but also for diesel cars and light utility vehicles. They called on the manufacturers to increase their research and development activities in this area. The target is EURO V. This should make particle filters for cars and light utility vehicles (N1-utility vehicles) compulsory throughout Europe.

For EURO III and also EURO IV, the limiting particle values refer to the total emitted particle mass, as it is determined in accordance with the definition of the measurement method, gravimetrically in the thinned exhaust. However, for an effect-related limitation, other parameters would be more important, such as the number of particles in certain classes. This requires further research work and at the end of the day, an agreement at European or international level. This will probably not happen for several years to come.

Possible ways of reducing dust

The main emission reducing measures suggested are the further, increased use of filtering separators as well as electrical separators and, in the mobile sector – as mentioned – the use of soot filter in engines.

Further possible ways of reducing dust emissions which have already been widely tested are primary measures. These include process-optimising measures such as changes to car and lorry engines, improved recording of process gases of diffuse sources in industry and in storage with subsequent feed to a separator. These also include the use of low emission fuels and energy conservation measures.

More extensive measures aim to reduce the emissions of precursor substances such as nitrogen oxide, sulphur dioxide, ammonium and VOC, where these have a man-made origin. (// 6, 13)

10. From the Federal Communicable Diseases Act to the Protection Against Infection Act

Infectious diseases are the worldwide number one cause of death (Table 10). Of the 52 million humans dying worldwide every year (as per 1996), 32 million die of infectious diseases or of their consequences.

In the 1970's, it was still believed that the final victory over infectious diseases was only a question of time. Due to the developments of the last 20 years (AIDS, legionellosis, cryptosporidiosis), this optimism has been greatly dampened.

Even the control of animal transmitters of pathogens (vector control) faces new challenges, whether through the increasing worldwide spread of pathogens by means of transport or through the strong increase of scabies and head lice infections in community facilities. In 1999, the work of the Federal Environmental Agency (UBA) on this complex topic was marked by the preparations for the new *Protection Against Infection Act (IfSG)*, which is expected to be passed in by the Bundestag in 2000* and will replace the *Federal Communicable Diseases Act (BSeuchG)*. The BSeuchG which dates from the 1960's, cannot appropriately react to the present day challenges of infectious diseases. In the new IfSG, "seeking epidemiology" plays a central role. It is oriented to tracking down new developments in infectious diseases so early that society and institutions can react in good time.

Risks from infection via drinking water and swimming pool water

Apart from the epidemiological focal points, which are to be managed and implemented by the Robert Koch Institute (RKI), the new Act will create further

* IfSG passed the Bundestag in 2000 and came into force on 1st January 2001.

Table 10: The nine most important infectious diseases worldwide (1995)

Infectious disease	Deaths/Year in millions
Acute respiratory tract diseases	4.4
Diarrhoea	3.1
Tuberculosis	3.1
Malaria	2.1
Hepatitis B	1.1
AIDS	> 1
Measles	> 1
Tetanus (in the newly born)	0.5
Whooping cough	0.39

Source: World Health Report, 1996

prerequisites for the prevention of infectious diseases. These also include the prevention of infections which can arise from an imperfect water supply or due to contact with water when bathing in swimming pools. Because wastewater disposal directly influences the hygiene status of bodies of water – and therefore indirectly the drinking water supply, wastewater hygiene receives particular attention in the IfSG (see also Chapter 11).

§ 37 of the draft IfSG contains the requirement for the provision of flawless drinking and bathing water as well as the duty to monitor them. These result in the following tasks for the UBA:

Drinking water:

- Research into the behaviour of epidemic-hygiene relevant microorganisms in the bank filtration of river water as well as natural ground water replenishment for drinking water extraction
- Assessment and development of treatment methods for ground and surface water and for water for ground water replenishment in the area of drinking water supply

- Investigations for the verification and on the ecological behaviour of pathogenic organisms important for water hygiene (bacteria, viruses, parasites) as well as their behaviour during drinking water treatment
- Editing microbiological criteria for the treatment of reservoir water as drinking water
- Dealing with the questions regarding the disinfection of drinking water
- Use and further development of the methods for the hygienic-bacteriological investigation of drinking water
- Behaviour of bacteria in drinking water distribution

Swimming pool water

- Hygienic assessment of the technique of swimming pool water treatment and the operation of swimming pools
- Evaluation of health-relevant microbiological quality parameters of swimming pool water
- Registration and constant up-dating of agents and methods used for treating the water

Wastewater

- Determination of state-of-the-art for the removal or inactivation of pathogens from wastewaters
- Producing requirements for the discharge of wastewaters
- Producing suitable monitoring parameters.

Overall, it is the responsibility of the Federal Environmental Agency to develop concepts for the prevention and identification and to hinder a further spread of illnesses transmitted by water (§ 40 IfSG).

These include the assessment of risks to health which result from the respective pathogens. This task is given central significance, because the measures to be taken and their costs depend on it. The topic of risk assessment of infectious diseases in the environmental sector is dealt with in detail in Chapter 7.

Risks of infection from animal pests

Within the framework of implementation of the current § 10 c BSeuchG (new: § 18 Para. 1 and 2 IfSG), the UBA tests the efficacy of insecticidal, acaricidal and rodenticidal products under vector eradication principle to control rodent and arthropod pests. The

vector eradication is synonymous with the interruption of the vector chain and at the same time the prerequisite for subsequent proper disinfection in the case of transmittable diseases. These tests are carried out with non-agricultural products which are not intended to use on or in humans and animals. Products for the control of lice and scabies are tested according to § 10 c in conjunction with §§ 45 ff BSeuchG (new: § 18 Para. 1 u. 2 in conjunction with § 34 Para. 1 IfSG). They must act on the users of schools and other communal facilities so that, following their use, there will no longer be any fear of further spread of the parasites in the institutions mentioned.

Listing the eradication products and methods

In 1999, the UBA tested 11 eradication products and methods – mostly for several target arthropods – and 12 for rodent control in practice, in locations at risk from epidemics, regarding their effectiveness and application. 36 products and application procedures were put through the appropriate laboratory tests. 19 successfully tested products were suggested to the Federal Institute for Health, Consumer Protection and Veterinary Medicine (BgVV) for listing. The laboratory and practical investigations of pest control products against arthropods, rats and mice are carried out at the UBA while incorporating manufacturers' data. The agency tests the efficacy of the products and the acceptance of their proper use with regard to the environment. The tests for effectiveness against other vertebrates than rats and mice are undertaken by the BgVV.

The BgVV, as the managing administrative authority, publishes in agreement with the UBA and the Federal Biological Agency for Agriculture and Forestry (BBA) the revised and commented new issues of the lists to § 10 c BSeuchG (new: § 18 IfSG) of the insecticides, acaricides and rodenticides usable for vector extermination measures ordered by health authorities.

Following the coming into force of the IfSG, the extent and structure of the eradication products and methods lists mainly remain unchanged. This also applies to their subdivision according to short and long-term products, formulation types (type of preparation) and active ingredient as well as target animal indications. The list should not be subdivided in more depth – be

it according to types of target locations or target materials.

The changes contained in the draft for § 18 IfSG compared to § 10 c BSeuchG serve to more precisely state the responsibilities for the testing of lice and scabies agents by the Federal Institute for Medicines and Medical Products (BfArM). It tests the effects of these medicines on the health of humans in accordance with § 18 Para. 2, 2.a) IfSG, as far as it is responsible for their licensing in accordance with § 77 Para. 1 Medical Drugs Act (AMG).

As long as only medicines requiring licences in accordance with § 77 Para. 1 AMG are tested, the IfSG contains no changes to the present testing practices and the cooperation between the UBA, BgVV and BfArM.

Support of the testing

In individual cases, adoption of the results from the plants and storage protection biocides testing according to the new regulation in § 18 Para. 2.b) IfSG could support simplifying the testing activities of the UBA regarding questions of efficacy. This possibility results above all for certain agents and methods for the control of rats and mice in urban settlements. In the arthropod sector, however, the ranges of target animal types and target locations are so different, except for a few exceptions, that the UBA can only in rare cases adopt results from the plants and storage biocides testing with respect to the detection of the efficacy and application according to the IfSG.

If such results are adopted by the responsible Federal authorities, the UBA or BgVV, for their tests to § 18 IfSG, then it will be necessary to undertake the entomological and toxicological assessment of the products using the application techniques usually used by for epidemic hygiene in the target locations. This could be, for example, a hospital, where the ways in which the different target rooms and materials are used as well as the relevant legal regulations must be taken into consideration.

The standard of equivalent testing according to the eradication principle applies in epidemic hygiene for all situations of room and target surfaces use. This standard should be considered in those cases in which the responsible Federal authority commissions an expert report. It will also be possible for the

first time to place such orders for reports according to § 18 Para. 2, penultimate sentence of the IfSG for the areas "efficacy" and "justification of the effects on the environment" to be tested by the UBA to epidemic legislation.

Guidelines for product testing

Due to the possibility provided by § 18 IfSG of awarding effectiveness and application tests to non-authority experts, it will be necessary for the UBA to take up a lead management role via its eradication product commission in the production of testing guidelines (efficacy and application testing). The same applies with respect to the creation of guidelines for decontamination agent and methods testing.

At the request of the Länder, the UBA and the BgVV as well as – for lice and scabies – the BfArM will have to assist in fulfilling their specialist powers according to § 17 IfSG (equates to § 13 BSeuchG) on the basis of their respective responsibility and specialist competence. The reason is, that apart from a few exceptions, the Länder no longer employ any entomological-parasitological specialist personnel.

The growing problem of gaps in indications in the BgVV list will not be removed by the new IfSG. In some cases, it is a consequence of the virtual lack of reference research in Germany, but also the withdrawal of manufacturers from economically less attractive, but infectiological important indications. At present, the gaps in indications affect head lice and scabies, mosquito larvae and pupae, pigeon and brown dog ticks as well as domestic mice. A special factor in controlling such pests, in particular the ticks, is the inadequate development of complex methods effective over the long-term. This also applies for methods which are to be used in aeroplanes and in other means of transport. Such methods must have been adequately tested under practical conditions in the target type of vehicle with respect to specific-entomological, health and safety aspects. Certain vector-parasitically or pure ectoparasitically caused illnesses such as the tick-borne encephalitis and borreliosis, as well as scabies and lice should – as to date – be controlled by measures covered by epidemic legislation and flanked by reference leaflets for doctors published by the UBA in cooperation with the RKI, BfArM and BgVV. (IV 1.5)

11. Strategies for clean water

The protection of bodies of water against the discharge of hazardous substances and nutrients has to date been realised in Germany using the emissions principle. This means that emissions must be reduced at the location of their discharge by best available techniques. The reduction of emissions shall be aimed for in all cases for precautionary reasons even if there is no concrete hazard. In this way, considerable successes have been achieved in water pollution control. The emissions principle is and remains the basis of the water protection policy in Germany.

In recent years, traditional emissions-oriented water protection in Germany has increasingly been supplemented by quality requirements. Here quality targets are used which stipulate the strived-for condition of waters. Doing this, standards are defined for the success of the water protection policy, so that water protection can be tailor-made to remove deficits that still exist today by additional measures that supplement the best available technique. Best available techniques, however, are not sufficient as an approach to water protection especially if widespread pollutant loads are to be reduced from diffuse sources.

Diffuse loads: Plant protection products

One example for this problem is water pollution load due to Plant protection products (PPP), whose discharge into waters derives only to a small extent from chemical plants. Open application in agriculture is the main source (see also Chapter 14).

In 1999, the Federal Environmental Agency (UBA) has assessed data on the relevance of PPP on waters based on the monitoring programmes of the Länder (States). The actual loads were compared to target values which aim to protect the aquatic biocoenoses and the most important usages – such as drinking water abstraction.

In the Länder, investigatory programmes are currently underway which are oriented to areas with

intensive agriculture – in Hessen around the catchment area of the Nidda. Others concern waters which are relevant for drinking water abstraction, such as the Stever in North Rhine Westphalia and the impounded dam tributaries in Thuringia. Target levels of 0.1 micrograms per litre ($\mu\text{g/l}$) per active substance for protecting the “drinking water supply” were already made compulsory in 1997 for 38 pesticides which are deemed potentially relevant for waters due to the production quantities and the quantities used. To protect aquatic life, some target levels are significantly more stringent.

Testing of these target levels by the UBA has shown that in the period 1996 to 1998, the target levels for the active substances a-endosulphane, azinphos-methyl, diuron, isoproturon and mecoprop were more frequently exceeded (> 25 % of the investigated measuring points). In 27 of the 38 PPP active substances, target levels have been exceeded. Only for 6 active substances the target levels complied with both protective purposes. An overview of the actual/planned comparison with identification of upper deviations from the target levels in the years 1996 to 1998 is given in Table 11 (page 61).

As the concentrations identified for the PPP frequently lie close to the limit of detection, at present statements can only be made for relatively few active substances regarding the development of the load. A reduction in the load has been recorded for atrazine, simazine and lindane. For diuron and isoproturon, on the other hand, they remain just as high.

Implementation of the EU requirements for water protection

In general, German water protection legislation does not yet provide legally binding quality targets. Thus, Germany has not met its obligation according to the *EC Water Protection Directive (76/464/EEC)* to implement programmes and quality targets for the reduction of water pollution loads of 99 hazardous substances.

Table 11: Overview of the upper deviations of the target levels of the Working Group of the Federal States on Water for active substances in pesticides during the period 1996–1998

Name of substance	Target level for aquatic biocoenoses in µg/l	Upper deviation of target level				Percentage figure for the upper deviation not possible*
		0%	Up to 10%	>10 to 25%	>25%	
2,4-D	2	A		T		
a-Endosulphane	0.005	T			A	
b-Endosulphane	0.005	T		A		
Ametryn	0.5	A	T			
Atrazine	-			T		
Azinphos-methyl	0.01		T		A	
Azinphos-ethyl	-	T				
Bentazon	70	A		T		
Bromacil	0.6	A, T				
Chloridazone	10	A		T		
Chlortoluron	0.4			A, T		
Dichlorprop	10	A		T		
Dichlorvos	0.0006		T			A
Dimethoate	0.2		A	T		
Diuron	0.05				A, T	
Etrimphos	0.004	T			A**	
Fenitrothion	0.009	T				A
Fenthion	0.004			A, T		
Hexazinon	0.07		A, T			
Isoproturon	0.3				A, T	
Lindane	0.3	A, T				
Linuron	0.3	A, T				
Malathion	0.02	T		A		
MCPA	2	A		T		
Mecoprop	50	A			T	
Metazachlorine	0.4	A	T			
Methabenzthiazuron	2	A	T			
Metolachlorine	0.2	A	T			
Parathion-methyl	0.02	T				A
Parathion-ethyl	0.005	T				A
Prometryn	0.5	A, T				
Propazin	-		T			
Simazin	0.1		A, T			
Terbuthylazin	0.5	A	T			
Triazophos	0.03				T**	A
Tributyltin-cation	0.0001	T		A**		
Trifluralin	0.03	A, T				
Triphenyltin-cation	0.0005	keine Daten				

Target level for protective purpose "drinking water supply": 0.1 µg/l

T = Protective purpose "drinking water supply" A = Protective purpose "Aquatic biocoenoses"

* Target levels exceeded; percentage figure not possible, as limit of determination at least 50% of the measuring points is larger than the target level

** Statistically not reliable, as number of measuring points < 15

The justification that the stringent German minimum requirements for wastewater discharges to best available technique standards dispenses with the need for legally binding quality targets was not accepted in the decision of the European Court (EuGH) of 11th November 1999. Even the target level concept for water quality which, following extensive preparatory works, is mainly used in the execution, is not sufficient for implementation of the directive.

The UBA sees the court decision as an opportunity to introduce already sufficiently sharply outlined concepts for quality oriented water management for a limited number of substances. It has produced a draft ordinance at the end of the year for the Federal Ministry for the Environment which is intended to implement the EC Water Protection Directive. The draft contains practical quality targets for the substances named in the court decision. The quality targets are determined according to the target level requirements of the LAWA (Working Group of the Federal States on Water). The discussions concerning the content and exact layout of the ordinance will probably last for the whole of 2000.

A new water protection strategy

The EC Water Protection Directive 76/464/EEC as well as the other usage-related individual directives will be successively integrated in the coming *EC Water Framework Directive*. This primarily pursues an immissions-related approach. At the insistence of Germany, the so-called "combined approach" was included. This means that apart from the quality-related requirements, there is also an obligation to reduce emissions according to the best available technology.

The universal aim of the framework directive is to achieve a "good status" of the waters. The "good status" is defined such that waters may be influenced by human usage, but only as far as the ecological functions of the waters are not impaired.

The approach of the directive to assess the water quality primarily according to ecological criteria, is also based on preliminary work of the UBA. In addition, the detailed arrangements for the requirements of the "good status" in the technical annexes were accompanied and characterised by the UBA. The ecological requirements of the proposed Framework

Water Directive were supplemented and filled with the quality requirements for certain chemicals.

Where the aquatic biocoenoses in waters are impaired by chemical pollution, quality targets have to be stipulated for each of the respective substances. With the participation of the UBA, a method has been developed for deducting these quality targets which is closely oriented to the stringent concept of the German target levels.

Around 30 EU-wide priority substances were included in an initial list. For this, uniform requirements, in particular quality targets too, will be stipulated by subsidiary directives to the Water Framework Directive. The UBA suggested a list of priority substances developed by the Fraunhofer Institute for Environmental Chemistry and Ecotoxicology, Schmallenberg, [3]. This suggestion is the basis of the still ongoing discussions within the European Union.

Different international methods

The Water Framework Directive is met by historically grown, different approaches to the assessment of water quality in the various member states. To achieve future agreement in the qualitative requirements, the UBA has had the different assessment methods of the member states investigated in a research project.

The research in 40 European and important non-European countries uncovered around 18 water assessment approaches. In direct comparison, they are very heterogenous in parts. In some countries, the assessment is oriented to the environmental policy priority of measures, in other countries to the natural science and thus specialist requirements. The legal obligation of the quality requirements is also not always comparable: Apart from legally binding quality standards, i.e. compliance which is compulsory, in a large number of the countries non-binding guideline values are also used, representing a more long-term oriented environmental policy framework.

The quality requirements of the individual countries can still be best compared to each other with respect to the physical-chemical characteristics. With the target levels formulated by the LAWA in cooperation with the UBA, Germany mostly lies in the middle of the field. The overview produced of the currently applicable international requirements for water quality

is very comprehensive: It includes the commonly used classic dimensions such as “nutrients” or “chloride” as well as the heavy metals and a broad spectrum of organic micro-contaminations. A comparison between the biological and hydro morphological quality requirements is not yet possible due to significant conceptional differences.

The next steps

The consequences of the EuGH decision and the pending EC water framework directive will significantly change German water legislation. The negotiations make it clear that implementation of the EU legal requirements in the German enforcement will be made easier by the early influence and contribution of the German point of view at all levels.

- The decisive impetus for the development of legally binding quality targets is based on the work for the EC Water Framework Directive. It is intended to stipulate good water quality throughout Europe as a water protection target. Initially, not only quality targets for the chemical property of water will be formulated, but above all ecological requirements with respect to the protection of typical natural environment biocoenoses taking into consideration characteristics for biology, chemistry and hydro morphology (water quantity and morphology) too.
- The practical requirements which the Water Framework Directive sets for water quality can only be defined on the basis of adequate knowledge of the occurrence and effects of nutrients and pollutants. With its continuous coordination and assessment of the measured results of the states and with its research work into the load and loadability of aquatic biocoenoses, the UBA makes substantial contributions.
- The application of the quality targets in the practical enforcement will soon commence with the implementation of the *EC Water Protection Directive 76/464/EEC*. The management of the waters according to the quality targets stipulated in the ordinance will at the same time be the trial run for future implementation of the Water Framework Directive.

(II 3)

[3] Revised Proposal for a List of Priority Substances in the Context of the Water Framework Directive (COMMP5 Procedure) (EU Commission, 98/788/3040/DEB/E1)

12. Strategies for protecting soil

The *Federal Soil Protection Act (BBodSchG)* came into effect on 1st March 1999 and the *Federal Soil Protection and Contaminated Sites Ordinance (BBodSchV)* on 17th July 1999. They are the preliminary conclusion of the environmental policy initiative for the protection of soils and for the improvement of the rehabilitation of harmful soil changes and contaminated sites. The protection of the “third medium” after air and water has thus been established.

However, this does not bring soil protecting strategies to a stop. On the contrary, now the task is to prepare the arrangements for the soil protection legislative framework. To do this, the expertise and knowledge bases required for proper enforcement must be created.

It is of particular importance to soil protection that the standards and methods are disclosed with which the pollutant concentrations of the soils are assessed. The Federal Environmental Agency (UBA) has put together the specialist derivative principles for the test and measures values of the BBodSchV in a publication [4] of the Federal Ministry for the Environment (BMU). This publication is mentioned in the BBodSchV and provides specialist instructions for enforcement.

To further concretise the derivation of the values, the UBA calculations of test values, which are based on the derivative principles, have been published in a manual.

The Scientific Advisory Board on Soil Protection (WBB) of the BMU which commenced its work in 1999, has provided substantial assistance for the production of both the publication and the manual. The UBA leads the business of the advisory board. It provides assistance for the development of soil protecting strategies. In particular, it has emphasised the necessity for further research efforts on soil protection to the Federal Ministry of Research (BMBF), produced a recommendation for the continued development of leachate prognoses and included the work in a report for the ex-

tended precautions in soil protection. The advisory board has produced 90 recommendations for the implementation of the extended precautionary philosophy which are oriented towards BMU and the specialist departments concerned. The report was handed over at the start of 2000 to the Parliamentary Secretary of State in the BMU, Simone Probst, and in the meantime is available as a Bundestag publication.

Effects of pollutants on soil organisms

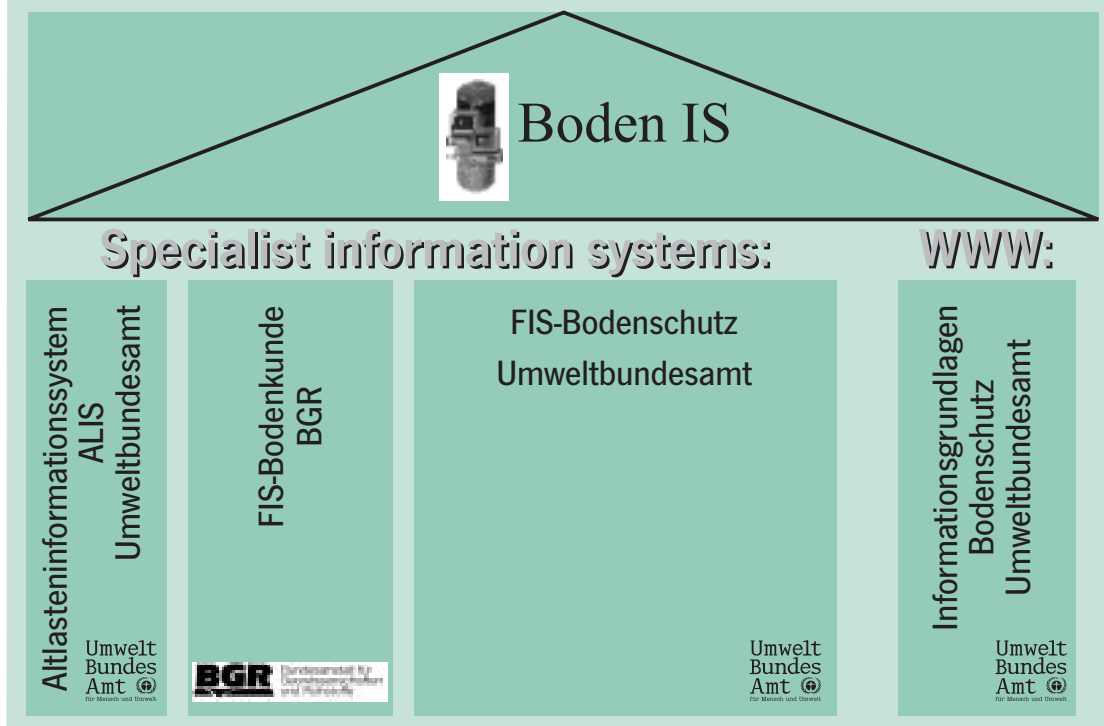
The aim of one research project was to determine whether the test values deduced for arsenic, cadmium and benzo(a)pyrene (BaP) for the protection of human health according to the BBodSchG also serve the protection of the habitat functions for soil organisms. To this end, the Fraunhofer Institute for Environmental Chemistry and Ecotoxicology (IUCT), Schmallenberg, carried out ecotoxicological tests on selected soils whose pollutant concentrations were set to the level of the test values by adding highly contaminated soils.

The results can be interpreted – subject to the effects of the addition of highly polluted and unpolluted soils – such that the habitat functions of the soil appear secured for nematodes (threadworms) and plants in the area of the test values (parks and leisure facilities as well as farming and orchards) for all three contaminants tested.

This also appears to apply for microorganisms for the pollutants cadmium and arsenic. For BaP, there is doubt in this respect, although it cannot be precluded that the chemical-physical soil parameters for this contaminant could have influenced the results.

Suggested test values for further priority contaminants are being produced within the framework of the current research project “development of ecotoxicological orientation values for soils”.

Figure 11: Simplified structure of the Soil Information System



Assessment of soils quality using plant and animal bioindicators

Bioindication is used for the long-term investigation of permanent observation areas, to record trend developments of ecosystems at both unpolluted and polluted locations. The aim of the research project was to research, present and assess the level of knowledge and information on the assessment of inorganic and organic contaminants in soils using plant and animal bioindicators from literature. Because there are no generally recognised methods processes available for the bioindication of pollutants in soils, results of investigations should be collated from which the possibilities and limits of the use of plants and soil fauna as bioindicators can be deduced.

According to the task, definitions of bioindication were explained and the requirements of bioindication methods formulated by Umweltkonzept Dr. Meyer, Berlin. The significance of the priority inorganic and organic contaminants in soils were described with respect to possible pollutant effects on plants and soil fauna and the influence of abiotic and biotic factors on their bio-availability listed.

The researched results of the investigations on the uptake and effect of the contaminants as well as their reactions, separated according to plant and animal bioindicators, were presented and assessed. At the same time, the suitability of plants – wild plants and grasses, cultured plants, trees, fungi – as well as soil fauna – rain worms, woodlice, millipedes, mites, pintails, spiders, threadworms, enchytreas, snails – as possible bioindicators was developed.

The conclusions highlight plants and soils fauna species with verified and possible bioindicative potential and name factors which limit the use of bioindicators. Gaps in knowledge of the dosage-effect relationship between pollutants and plants or soil fauna as well as further need for research for the development of suitable bioindication methods were listed.

Examination and assessment of terrestrial ecotoxicity

Within the framework of the research project, Triton, Halle, examined several substances using

standard terrestrial tests, to include the aspect of soil hazards within the system of water hazard classes (WGK) in future (see Chapter 15). If the approach is adapted for the deduction of WGK, the first task is to research which knowledge on the hazardous properties of the substance exists. Here the properties of the basic data set are of particular significance.

From the view of precautionary soil protection, the supplementation of previous risk (R) phrases by a new "compound is hazardous to plants" is recommended.

Germination inhibition or reduced growth (reduction of the biomass) within a certain period could be declared as hazard-determining characteristics. The execution of the trials should be carried out according to the standard DIN ISO 11269-2 ("Determination of the effects of pollutants on soil flora").

Phthalic acid diethylester (classified in WGK 2) and phthalic acid dimethylester (WGK 1) are to be assessed as hazardous to soils according to the investigations. Although both compounds are deemed easily biologically degradable, they appear to exert a soil hazard. Even at a concentration < 100 mg/kg clear toxic effects on plants can be determined.

The tests used are considered as adequate for a fast and economically justifiable initial assessment of the possible soil hazards. Nevertheless, in special cases and for further in-depth examinations, additional tests (for example soil respiration and nitrogen mineralisation) should be incorporated.

Biological soil quality classes

The aim of the research project, which was awarded to the IUCT, Schmalleberg, and ECT, Flörsheim, was to produce a concept for a biological location classification for soils.

The central idea is the comparison of expected biocoenoses of soil fauna at certain locations and the real occurrence. Soil usage and abiotic (inactivated) factors, such as soil properties and climate, considerably determine the respective biocoenoses of soil fauna. With respect to the soil fauna found, primarily qualitative measured parameters, such as the spectrum of families and species are used. (// 5.1)

Information principles for soil protection

Effective soil protection requires a well-founded database on both an international and national level which imparts adequate information of the objects to be protected. It should give evidence about changes to the soil over time and space including its reaction to anthropogenic influences.

A series of international and national tasks result for the Federal Government. These include for example:

- Reporting to the European Environment Agency (EEA). In future, contributions to Europe-wide presentations on soil condition and hazards will be expected, for example within the framework of the regular reports on the "State of the Environment (DOBRIS +)"
- Fulfilment of binding resolutions of the EU (§ 22 BBodSchG)
- Duty to inform the general public (for example "data on the environment" and partial contributions on soil protection for environmental reports of the Federal Government).

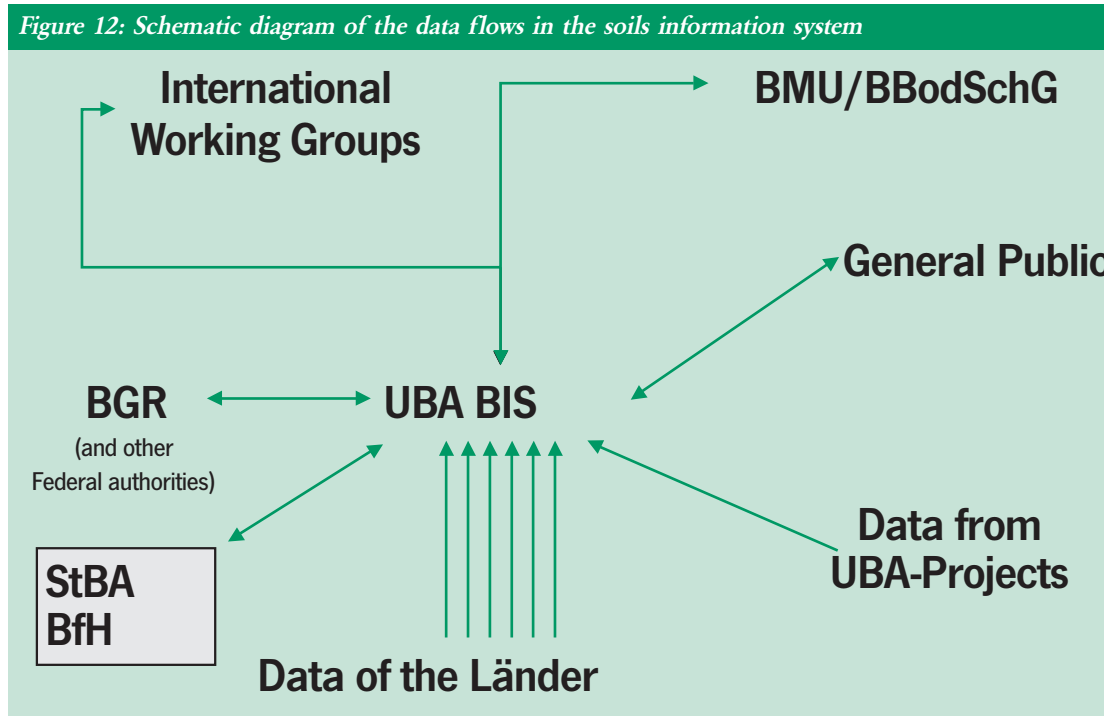
The Federal Government is prepared to make the information base available at both a Federal and States level on soil protection usable for enforcement by setting up a soils information system. To enable the data exchange, an appendix on soil has been produced within the framework of an administrative agreement between the Federal Government and the Länder on data exchange in the environmental sector and was passed by the environment ministers' conference. The Federal Environmental Agency has commenced the set-up of a nationwide Soils Information System (Figure 11, page 65). The idea is to use a modular system which serves different tasks and user groups differently. (Figure 12).

The limited access possibilities to the actual system make it necessary to make the important data contained in the BIS available to the interested general public separately. This information is made accessible to users via the Internet. To achieve this, the Environment Data Catalogues (UDK) are used (see Chapter 2). (// 5.2)

Contaminated sites

With the coming into effect of the Federal Soil Protection Act and the Federal Soil Protection and Con-

Figure 12: Schematic diagram of the data flows in the soils information system



taminated Sites Ordinance, the legal regulations for contaminated sites have been improved and completed at Federal level. In 1999, the Länder Thuringia and Saxony-Anhalt concluded an agreement with the Federal Agency for Special Reunification Tasks (BvS), with which the level of the refinancing obligations of the Federal Government for the large Rositz and Potassium projects (Southern Harz and Werra) were regulated in a general contract and for the large Mansfeld project within the framework of a lump sum agreement for the expected rehabilitation costs. Thus, the responsibility for the implementation of measures was passed wholly to the respective Federal States.

The rehabilitation of the contaminated sites is increasingly being integrated into the management within the framework of recycling brownfields. It takes place less due to environmental aspects, but more due to area and usage concepts as well as opportunities for reusing revitalised industrial areas.

With simultaneous relief of the public budget, solution approaches are to be developed which make industrial wasteland reusable and noticeably reduce land consumption on "greenfield sites".

In urban areas of Germany, the amount of wasteland areas with suspected contamination is estimated at around 40,000 hectares. Project-related solutions for an ecologically, economically and socially compatible, thus sustainable concept for the structural change of these areas and regions were the aim of the research project "requirements of contaminated site rehabilitation within the framework of brownfield redevelopment."

Using an extensive questionnaire, numerous sample projects have been evaluated, so that the dependencies and deficits were able to be listed and recommendations for action and checklists produced.

Contaminants on site

In practice, the selected remediation measure frequently means that contaminants remain on site, or remediation measures are not carried out at all for various reasons. This requires monitoring of the suspected contaminated areas. In the research project "Development of monitoring programmes for contaminated sites", monitoring strategies were produced in the form of systematic, media-related mon-

itoring programmes for typical contaminant-specific and multifactor case arrangements.

With the provision of contaminated sites-specific information (<http://www.umweltdaten.de/altlast/web1/start.htm>) up to date results of research projects are to be made available online, to have an immediate effect on the specialist discussion. An overview of the software currently available in German-speaking countries is also given. (// 5.3)

[4] Bundesanzeiger (Federal Gazette) No. 161a dated 28th August 1999

13. Strategies for clean air

Since the 1960's, German air quality control policy has been based on the following principles:

- Protection against harmful effects on the environment as a result of immissions (specifically, air pollution, noise, electromagnetic waves are regulated) and
- Precautions against such harmful effects on the environment, in particular through application of state-of-the-art.

These principles manifest themselves in the *Federal Immissions Protection Act (BImSchG)* and in the meantime 28 ordinances (*BImSchV*).

Successes of air quality control

All these regulations serve to pursue the aim of keeping the air as clean as possible – and not so contaminated that is still allowed. This air quality control policy had the result of achieving excellent reductions

of any emissions throughout Europe (pollution which is discharged in the air). Examples are the marked falls in sulphur dioxide (SO₂) and nitrogen oxide (NO₂) emissions. The development of the total air pollution from volatile organic substances (VOC), carbon monoxide, benzene as well as – rather insignificant in terms of mass, however, due to their potential danger extremely important – air pollution such as dioxin, lead and dust (see Chapter 9) is comparable.

Finally, carbon dioxide emissions have fallen since 1990 about 16 % for the same reason: the very consequent implementation of the precautionary principle. The significant reductions in the emissions result in a clearly improved air quality in Germany.

Less success has been achieved to date by the efforts to reduce ammonia emissions. The most important source is agriculture. Ammonium is an air pollutant which is involved both in the acidification as well as in the eutrophication of soil and water.

Figure 13: Maximum values of ozone concentrations

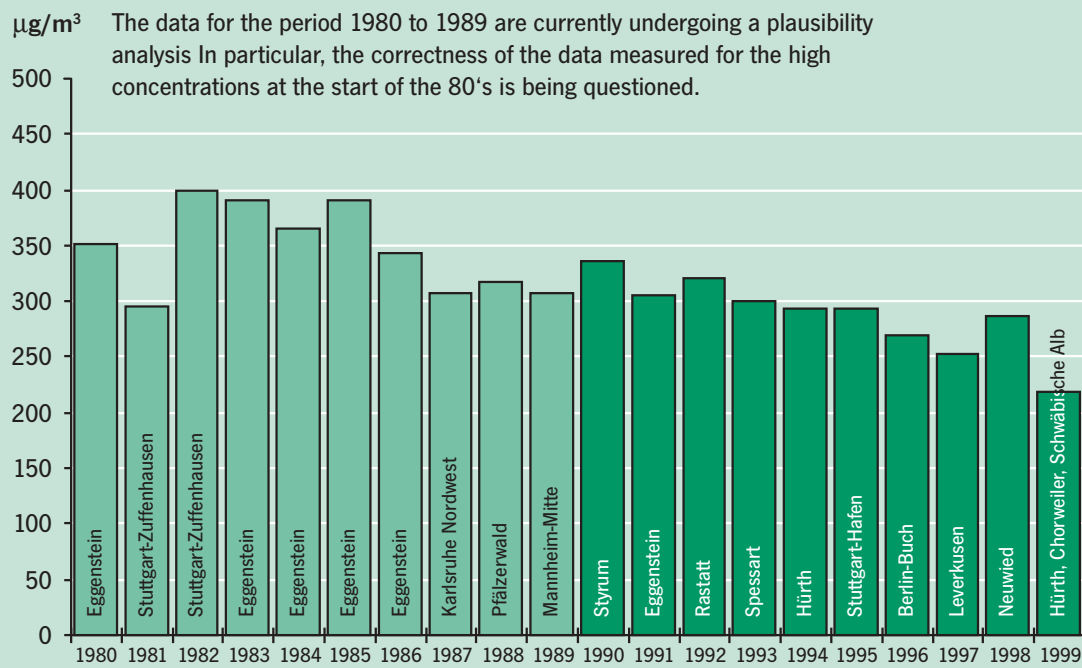


Table 12: Reduction of emissions according to the multi-effect protocol

in %	SO ₂	NO _x	VOC	NH ₃
ECE Overall	-63	-41	-41	-17
EU-States	-75	-49	-57	-15
Germany	-90	-60	-69	-28

The reductions in NO_x and VOC emissions are also accompanied by a reduction of the extremely high ozone concentrations. Figure 13 shows the maximum values for ozone concentrations measured in Germany since 1990 (1-hour values) and the annual frequency with which the threshold value for the information of the population was exceeded, being 180 µg/m³ in accordance with 22nd BImSchV.

Emissions ceilings

The UN-ECE Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone (<http://www.unece.org/env/lrtap/protocol/99multi.htm>) consequently continues the combat air pollution under the Economic Commission for Europe (UN-ECE) Convention on Long-Range Transboundary Air Pollution.

The objective of this Multi-effect Protocol is to reduce emissions of SO₂, NH₃ and VOCs in order to ensure that in the long term, critical loads of acidity and nutrient nitrogen as well as critical levels of ground-level ozone are not exceeded. National emission ceilings (NECs), to be complied with by the year 2010, are the regulatory centrepiece of the Protocol. The attainment of these NECs would nearly halve the area in which the critical loads of acidity are exceeded as well as the exposure of human beings and plants to ground-level ozone. Full attainment of the critical loads and levels will not be possible with the emissions abatement measures currently available. The Protocol also encompasses Annexes setting out emission control requirements for installations and products as well as for the transportation and agricultural sectors.

The negotiations for the Protocol were completed in September 1999 and the Protocol signed on 1st December 1999 in Göteborg. It will come into effect as soon as 16 countries have ratified it, which will probably take two or three years.

For Germany, this results in emissions ceilings of 550 kilo tonnes (kt) SO₂, 1081 kt NO_x, 995 kt NMVOC and 550 kt NH₃ per annum. Overall, the emissions ceilings of the protocol will lead to clear reductions in the four air pollutants concerned by 2010, compared to 1990 (see table 12).

Apart from the UN-ECE with its Multi-effect Protocol, the EU also pursues a similar air quality control policy with its "Acidification strategy" (<http://europa.eu.int/comm>). Within the framework of this strategy, the EU Commission has produced the draft of a Directive for Maximum National Emission Ceilings for Certain Atmospheric Pollutants (NEC Directive), which is intended to limit the same air pollutants as the Multi-effect Protocol. It could probably be passed during the course of 2000 and in accordance with the commission's current tables suggestion stipulate lower maximum emissions limits than the UN-ECE protocol.

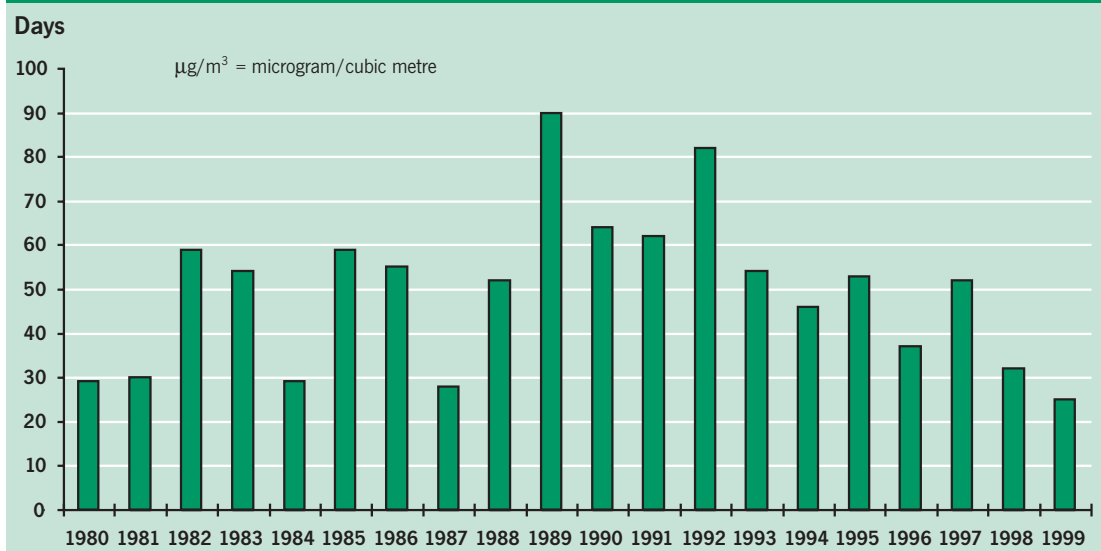
These targets should also be helped by an EC Directive for Large-Scale Furnaces, which will contain lower limiting values for emissions from new plant than the values of the current 13th BImSchV (Large-Scale Furnaces Ordinance) in Germany.

As pleasing as the Europe-wide stipulation of stricter limiting emissions values for new furnaces is, the refusal of many EU countries to even stipulate binding emission reductions for existing plants is very disappointing. This shows that the European air quality policy still has a long way to go.

The EC Solvents Directive with limitations and reductions for solvent emissions from plants which has already been passed, should help the "acidification strategy" to progress, especially in the control of surface ozone. The UBA has made a proposal as to how the effect of this Directive on the reduction of VOC emissions could be improved even more by the implementation of the directive into German law.

It can be seen from these obligations and measures that in large areas of Germany – however, not the whole area – the acidification (acid in rainfall, air pollution with an acidifying effect) will reduce so far by the year 2010 that soil and waters will no longer be overloaded. In addition, by then the nationwide exceeding of the ozone concentration of 180 µg/m³ (information value of the 22nd BImSchV) will be a thing of the past. However, this will mean that one of

Figure 14: Ozone – number of days with upper deviations of 180 µg/m³



the many environmental problems caused by ozone will have been solved. Ozone concentration values for the protection of human health and sensitive plants, such as the 8-hour average value of 120 micrograms per cubic metre suggested by the World Health Organisation will not have been complied with. Furthermore, it will not be achieved as long as there is no huge, further reduction in NO_x and VOC emissions in the whole of Europe and in North America.

A causal-oriented approach is also pursued by the EC Framework Directive on Ambient Air Quality (96/62/EC) with its subsidiary directives. They substantially determine the further development of the pertinent German regulations.

The first Daughter Directive for SO₂, NO₂, NO_x, lead and dust (PM₁₀ = dust with dust particles smaller or equal to 10 µm diameter) stipulates limiting immissions values which are to be complied with by the member states by 2005 at the latest (for NO₂ until 2010).

Of all the limiting values named in the Directive, the values for PM₁₀ are still most clearly exceeded in Germany today (see Chapter 9). Assessments of UBA measuring network data and the measuring networks of the Länder by the UBA show that in Germany the limit values for SO₂ can be relatively easily complied with. Of the other values, only the short-

term value for NO₂ (99,8 % value of the average hourly values 200 µg/m³) is exceeded on very heavily trafficked roads and the value for lead (0,5 µg/m³ as an annual average) only, almost as an inherited load, in the immediate neighbourhood of former lead works. The NO₂ concentrations of air in the vicinity of heavily trafficked roads continue to reduce so significantly that even according to only rough estimates the limiting value should have soon been reached.

Carbon monoxide and benzene

The situation for another Daughter Directive for carbon monoxide and benzene is similar. The limit value for carbon monoxide has already been complied with in Germany for several years. For benzene, for which a limit immissions value of 5 µg/m³ was suggested as an annual average, annual average values of up to 10 µg/m³ are currently still being recorded for very heavily trafficked roads in Germany. As, however, the value of 5 µg/m³ will not be binding until the year 2010 and benzene emissions from traffic will have fallen by significantly more than 50 % by then (result of model calculations by the UBA), this limiting value should be able to be complied with in Germany.

Apart from the uniform EU requirements for the measurement of air pollution and the limiting immissions values – similar to the air quality guidelines

that presently apply – binding plans have to be submitted in the cases in which limiting immissions values are exceeded. The preparation of such plans still requires scientific development.

The EC Directives as well as new knowledge of the effects of air pollution and the continued development of state of the art make an adjustment to the German immissions protection legislation necessary. At the same time, the most recent UN-ECE protocols on heavy metals and persistent organic compounds (POP, see page 13) and the Göteborg Protocol must also be taken into consideration.

These regulations require amendments to the *BlmSchG*, the 4th *BlmSchV*, der 9th *BlmSchV*, the 13th *BlmSchV*, the 17th *BlmSchV* and the *Technical Instruction (TA) for Air Quality*.

Overall, as a result of the measures already taken and those pending in the foreseeable future, it is to be expected that the air quality will continue to improve. However, there is still a need for action to be taken, above all with respect to acidification, surface ozone, fine dust and control of a large number of air pollutants, the effects of which are still unknown.

(II 6)

14. Precautionary and sustainable substances policy

14. Precautionary and sustainable substances policy

The European chemicals policy is being reoriented. In June 1999, the poor efficiency of the implementation of the European existing chemicals programme, contradictions in the substance policy aims of the *Seawater Protection Convention* as well as an unclear and inadequate consideration of the precautionary principle caused the Council of Environment Ministers under German presidency to draw conclusions for a new approach. The EU Commission will submit a communiqué to the Council in summer 2000 in which they explain how they intend specifically implementing the requirements of the environment ministers.

Environmental quality and action targets are required as an orientation aid for a "secure ecological direction" for a precautionary and sustainable substance policy orientation. The Federal Environmental Agency (UBA) has presented five substance policy environmental action targets in a study. The essential conclusions:

Persistency, bioaccumulation, mobility

The irreversible discharge of persistent and bioaccumulating or persistent and highly mobile foreign substances in the environment should be completely avoided, independent of their toxicity. This also applies to substances whose metabolites have such properties. In the case of a long-term location of xenobiotics in the environment, adverse effects, which may not even yet be known nor have been investigated, can never be fully precluded. In conjunction with an enrichment in organisms or higher mobility, this presents a particularly high risk.

Carcinogenic, mutagenic or reproduction-toxic

The irreversible discharge of foreign substances with carcinogenic, mutagenic or reproduction-toxic effects (CMR-substances) in the environment must be com-

pletely avoided. This also applies for substances whose metabolites have such properties. These properties affect the central functions of organisms and ecosystems which can be irreversibly influenced as a result.

Release of hazardous natural substances

The anthropogenic (caused by humans) release of natural substances which are persistent and bioaccumulating or persistent and highly mobile or which have carcinogenic, mutagenic and reproduction-toxic effects, must not lead to an increase in the natural background loads. This requirement is accompanied with the first two aims. It is not possible to achieve a zero loading for natural substances.

The anthropogenic discharge of other toxic or ecotoxic substances (some of which are natural substances), that do not already fall into one of the named categories, is to be reduced to the technically unavoidable level. This also applies to substances whose metabolites have such properties.

This requirement results from the principle of precautionary avoidance of the load with poisonous substances on the environment and human health.

Lack of recovery

An increase of discharges of substances into the environmental media caused by humans is to be avoided. This goes independent of effects identified to date and of other substance properties, if recoverability is not practically possible due to the widespread distribution or the low exchange. This means an avoidance requirement for emissions of substances not covered by the first four aims and targets a general reduction of loading. It applies in particular with respect to the atmosphere, sea and groundwater media.

Hazardous combinations of properties

The combination of the properties persistence/bioaccumulation is increasingly being identified as problematic in the European chemicals discussion. Independent of the result of a quantitative risk analysis (exposure/effect comparison) such substances are a risk, because their discharge in the environment is irreversible and long-lasting. Moreover, it can be accumulated in organisms to potentially harmful body concentrations. Knowledge of damaging effects is principally always incomplete. In some cases, a chronic biological effect is only observed in multiple generation studies which are expensive and therefore seldom produced. If new knowledge is obtained at a later date, the detrimental effects due to persistence over longer periods will not be able to be removed. This applies in particular for parts of the environment in which these substances remain widely distributed for a long time, such as the sea.

The property combination persistence/mobility also conceals a particular hazard. Highly mobile substances can, if persistent, spread over wide distances through the air and either affect chemical reactions in the atmosphere (as for example the fluoro-chloro carbons) or precipitate in areas remote from the emissions (for example the persistent organic compounds). High mobility in soils and in the groundwater is also particularly critical. If persistent substances have penetrated the groundwater aquifers, they remain in this sink long-term (see Chapter 11).

Groundwater damage might only be rehabilitated to a limited extent and become an acute problem if the groundwater is used as drinking water. Contaminated drinking water contradicts hygiene standards – independent of toxicologically founded limiting values. Examples of such substances are methyl-tert. butylether (MTBE) as a fuel additive and n-phenyl-sulphonylsarcosine as a metabolite of an anticorrosion agent.

Fields of action for substance policy

The environmental quality and action targets and the necessity to conserve resources result in the following fields for action:

- The material expenditure for products and services should be reduced: The necessary func-

tions are to be fulfilled with the lowest possible materials intensity.

- The consumption of natural material resources should be reduced. This field of action is to be understood as an impulse for the realisation of resource-saving technical progress.
- The use of energy in the life cycle of products should be reduced, in particular so that the discharge of mass pollutants such as climate-damaging carbon dioxide (CO₂) and acid formers is reduced.
- The long-term fitness for use of products should be extended: This is also a measure for the reduction of the flow quantities and is based on the durability and ease of repair of products as well as the technical adaptability to innovations.
- Environmentally compatible recycling must be improved: This field of action targets both the recoverability of the products as well as the environmental compatibility of the recycling process.
- Quantity and noxiousness of emissions are to be kept as low as possible. Technical material flows are to be kept separate from natural material cycles wherever possible.
- Material flows should become less complex: This field of action concerns both the multistage capability and networking of technical processes as well as accident risks, for example due to the potential hazard from intermediate products.
- The risk of overloading the environment with environmentally and health damaging substances must be reduced: This field of action concerns above all substances which are persistent and bioaccumulable /highly mobile, or toxic and ecotoxic substances in which the risk results from a comparison of exposure and effect under consideration of combined effects.
- Substances with properties compatible to both environment and health must be developed to be able to replace currently still necessary substances with hazardous properties.

The weighting of these fields of action varies for different substances and material flows. Competitive relationships cannot be precluded. Thus, in the case of substances used in the open environment such as plant protection products, the material properties and questions of application technology for reduction of quantities used are at the foreground. On the other hand, for substances being handled in closed systems (for example the toxic gas phosgene which is used as an intermediate product in polyurethane

manufacture), the controllability of the material flow is given particular attention.

These requirements were applied to, and examined in, the consideration and assessment of the complex material flow of polyvinylchloride (PVC) and the substances involved as an example. A differentiated image resulted:

A large number of the environmental problems which are associated with the mass produced plastic PVC, are caused by the additives used that are to be assessed as critical including stabilisers containing heavy metals, chloroparaffins and softeners. While cadmium, lead and organotin can be replaced by systems based on calcium/zinc, only a limited material substitution is possible with softeners. Soft PVC applications, for example in cable insulation, should therefore be replaced by other materials, for example networked polyethylene.

On the other hand, a substitution of hard PVC, such as an exemplary consideration of two selected PVC products shows (window frames and hard foils), does not lead to any significant reduction in the environmental risks when observing certain prerequisites. Hard PVC applications (even if they do not contain any chloroparaffins and are stabilised with calcium/zinc) will have to be assessed as critical if there are particular risks of fire, as PVC can frequently lead to an increase in toxic and visibility-reducing smoke and soot quantities, to material damage due to hydrochloric acid (HCl) corrosion and greater fire damages as a result of the fire. In addition, the whole material flow of PVC is highly complex which is associated with risks, especially in countries with low safety standards.

(IV 2)

15. Risk assessment and risk reduction of substances

In several product sectors, the risks of substances to environment and health are assessed and risk-reducing measures are developed. This applies for plant protection products (PPP) as well as for detergents and cleansing agents and – purely materials-related – both for new substances according to the *Chemicals Act (ChemG)* and existing substances in accordance with the *EC Existing Substances Regulation*.

During 1999, the Federal Environmental Agency (UBA) concerned itself with extending the approvals requirement to a further product range: to biocide products. The aim was also to further develop and harmonise the classification and labelling of environmentally hazardous substances.

In 1999, it also became clear that the work on risk assessment and risk reduction at EU-level was progressing too slowly. This applies in particular for the existing chemicals and the EU active substance testing for plant protection products. To change this, in their resolution of June 1999 the EU Council of Environment Ministers urged the EU Commission to submit suggestions for improving the methods used for producing risk assessment and risk reduction strategies as well as a new chemicals strategy. The UBA provided specialist contributions to the preliminary work for this resolution and the individual requirements. This also includes the suggestion for labelling previously not completely investigated substances. This should give the manufacturers the impetus to provide the investigations and data required for a risk assessment. It is to be expected that the EU Commission will present their new chemicals strategy by the end of 2000.

Approvals procedure for biocide products

To implement the *EC Biocide Directive (Directive 98/8/EC for bringing biocide products into circulation)*, work was carried out in 1999 on a draft *Biocide Act*. In this way, biocide products should in future be subjected to an approvals procedure in the meaning of precautionary environmental and health protec-

tion. The approvals decision will be based on a comprehensive risk assessment. The application area includes 23 types of products with four main groups (Table 13).

To prepare the tasks of the UBA within the framework of the approval, the management focus "Structure for enforcement of the Biocide Act" was set up. The aim is to create the conceptual, organisational and personnel prerequisites for realising the enforcement tasks. The UBA has many years of experience in assessment tasks as for partial areas of biocide products such as insecticides, rodenticides and disinfectants according to the *Federal Epidemic Control Act* (see Chapter 10) and for wood preservatives within the framework of the *Building Materials Act*.

The UBA participated at EU level in producing the *Technical Instruction for the description of the specific data requirements for the individual biocide product types*. The Instruction provides a flexible technical work instrument which will continue to be revised in the next few years, as new information and experience is available.

Further instructions will contain tailor-made test programmes and test strategies, exposure scenarios, and models as well as explanations of the approvals criteria as prerequisites for a harmonised assessment and approval of biocide products within the European Union. The already commenced revision of the *Technical Instructions (TA) for old and new substances* which is planned to also include biocides, is fundamental for this.

Within ten years, the old biocidal active agents should be systematically assessed at an EU level and a decision made regarding their inclusion in the "list of approved active agents". To achieve this the draft of an initial ordinance for determining the methodology for checking older biocidal active agents is under discussion. In an EU pilot project, the effective substance testing approach is being

tested using the example of two selected active agents. (IV L)

Risk reduction of triorganotin compounds

Triorganotin compounds are primarily used in antifouling products (tributyltin, TBT) and plant protection products (triphenyltin), in smaller quantities for materials protection and disinfectants and as an auxiliary reagent for special pharmantheses. Triorganotin compounds are found in waters, sediments and biota as well as in all investigated treated sewage sludges and wastewaters of domestic sewage treatment plants. The triorganotin concentrations measured are many times above the effective concentrations of these compounds.

Effects in snails and mussels caused by TBT are among the best-documented, hormonal effects triggered by contaminants. In a range of snails and mussels species, TBT can lead to the formation of additional male sex organs where a female genitalia system already exists (Imposex) and the formation of male characteristics in female animals or female organs in male animals (Intersex). In addition, it is larva toxic and can lead to severe shell deformations in molluscs such as oysters through a mechanism as yet unexplained.

Imposex and intersex finally lead to the sterility of the female individuals of a population. As a result, falls in population have been observed in the North Sea, as in the Wellhorn snail. In a range of mollusc species it is even feared that the population will be completely wiped out which would lead to far reaching consequences for the viability of other animal and plant species.

Antifouling paints in shipping

In 1999, the American draft of a convention for a worldwide ban on antifouling paints containing organotin was discussed within the framework of the Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO). The UBA is involved in the committee's workgroup for producing the convention. The aim is to pass the legally binding framework agreement at a conference in the year 2001.

Table 13: Scope of the Biocide Directive 98/8/EC

No.	Product types in accordance with Appendix V of the Biocide Directive 98/8/EC	Estimated environmental relevance
Main group 1: Disinfectant and general biocide-products		
1	Biocide products for human hygiene	Low
2	Disinfectants for the private sector and the public health sector as well as other biocide products	Low - high
3	biocide products for hygiene in the veterinary sector	medium - high
4	disinfectants for the food and foodstuffs sector	medium - high
5	Drinking water disinfectants	medium
Main group 2: Protective agents		
6	Pot-preservatives	Low
7	Coating preservatives	medium
8	Timber preservatives	Low - high
9	Preservatives for fibres, leather, rubber and polymerised materials	medium
10	Preservatives for masonry	medium - high
11	Preservative for liquids in refrigeration & process systems	medium - high
12	Slime abatement agents	high
13	Preservatives for metal processing liquids	medium
Main group 3: Pest control agents		
14	Rodenticides	Low - high
15	Avicides	high
16	Molluscicides	Low - high
17	Fish control agents	high
18	Insecticides/Acaricides	medium - high
19	Repellents and baits	medium
Main group 4: Other biocide products		
20	Preservatives for food and feedstuffs	Low-medium
21	Antifouling products	high
22	Liquids for embalming and taxidermy	high
23	Products against other vertebrates	high

Table 14: Classification of substances hazardous to water

0 to 4 Points:	WGK 1 (slightly hazardous to water)
5 to 8 Points:	WGK 2 (hazardous to water)
9 and more Points:	WGK 3 (very hazardous to water)

WGK=Water hazard class

The General Assembly of the IMO passed a resolution in November 1999 which provides for the worldwide ban on the use of antifouling paints containing organotin from 1st January 2003 and a ban on the presence of these paints on the ships hull from 1st January 2008. The existing EU limitation for the application of tin organic compounds in antifouling paints for boats with a maximum length of 25 m was extended in 1999 to a ban of non-chemically bound antifouling paints as well as for any length of ships, which primarily travel on inland waters (*EC Directive 1999/51/EC*).

In 1999, work was carried out on amendments to the *Chemicals Ban Ordinance* and the *Hazardous Substances Ordinance* with respect to antifouling paints for the implementation of the directive in Germany. In addition, a comprehensive *Ban ordinance for tin organic compounds* was prepared. (IV L, II 1.3)

Classification, packaging, and labelling of preparations

The *EC Preparations Directive (1999/45/EC)* regulates the classification, packaging, and labelling of preparations. These are all products consisting of mixtures of two or more constituents. Typical preparations are detergents. The Preparations Directive must be implemented as national law in the member states by July 2002 – and for plant protection products by July 2004.

According to the applicable national law, preparations only have to be classified and labelled with respect to their health-relevant and physico-chemical properties. According to the EC Directive, preparations also have to be classified and labelled with their environmentally relevant properties. Thus, the users will be provided with significantly more information enabling them to use products which are safe for the environment. Further important new features are the inclusion of the plant protection products (PPP) in the scope of the Directive and the extended obliga-

tion for commercial users to submit safety data sheets.

To date, the classification, packaging, and labelling of PPP has been regulated within the framework of the *Pesticides Directive (78/631/EEC)*. This only required that PPP be labelled with respect to their acute toxic effects and several physico-chemical properties. This resulted in extremely sketchy labelling and information for the consumer. Thus, for example, no information had to be provided on the risk of health damage with repeated application. According to the new Preparations Directive, from 2004 information has to be provided of all hazardous properties. This is also a significant improvement in consumer protection. The extension of the obligation to include safety data sheets, which are the most important source of information for commercial users, is also a step in the same direction.

The amendment to the Preparations Directive has still further reaching consequences for subsequent legislative areas beyond the labelling obligation. Thus, the classification of substances or preparations as environmentally hazardous is decisive for the measures which have to be taken for plant safety according to the *Seveso Directive (98/433/EEC)*. As preparations have not been classified as dangerous for the environment according to legislation to date, plants in which environmentally hazardous preparations are handled do not currently fall under the requirements of the Seveso-II-Directive. Following implementation of the Directive, the safety requirements of such plant will increase.

A similar approach will also apply for the waste and transport sectors. Here too, provisions which have to be made if individual substances are classified as environmentally hazardous, are not yet relevant for preparations, as these were not able to be classified as environmentally hazardous to date. (IV 1.1)

A contribution to the harmonisation of substance assessment

According to § 19 g *Federal Water Act (WHG)*, the Federal Ministry for the Environment classifies substances in water hazard classes (WGK) according to their dangerous properties. This classification is used in the water legislation enforcement of the Länder (States) to stipulate reasonable technical re-

quirements for the risk potential. These can be collection facilities, leakage displays and infrastructural measures for plants dealing with substances hazardous to waters.

In 1999, the new *Administrative Regulation on the Classification of Substance Hazardous to Waters* (VwVwS) came into effect which introduces a new assessment system. It may be used by the manufacturers and distributors to determine the WGK based on risk (R) phrases according to the *Ordinance on Hazardous Substances (GefStoffV)*. Thus, harmonisation is reached with the European hazardous substances legislation. All R phrases which describe the water endangering properties of substances are taken into consideration (protective aim: human health, aquatic ecosystems, soil or groundwater). Each R phrase is given a score according to its significance for these protective aims. The scores of all R phrases assigned for a certain substance are added to a total score from which the WGK results (Table 14).

In addition, "substances not hazardous to water" are defined in Annex 1 of VwVwS of May 17th 1999 which in future will no longer be subject to the regulatory scope of § 19g WHG if they fulfil the following prerequisites:

- 0 points according to the new assessment system
- Water solubility of less than 100 mg/l (or 10 mg/l for liquid substances)
- Not toxic to aquatic organisms (toxicity to two organisms have been tested, toxicity is greater than 100 mg/l or not in the area of solubility) and
- Easy biological degradability (for liquid substances).

The substances falling under these criteria are listed in Appendix 1 of the Administrative Regulation.

An essential difference between the chemical and water legislation is the "principle of precaution" anchored in § 19 g WHG. This requires that in the case of a lack of data or inadequate information, a high risk must be assumed initially. In contrast, according to the hazardous substances legislation, classification and labelling will only be required if it is known that the material has certain hazardous characteristics. The administrative regulation takes the following steps to express the principle of precaution principle using the language of the hazardous substances leg-

islation: A basic data set of four properties is defined: Acute toxicity to mammals, at least one ecotoxicity test on one aquatic organism, biological degradability, bioaccumulation potential. If there are no results of investigations on these properties available, which are required for the classification or for the exclusion of the respective R phrases, the respective maximum score is to be awarded as a "default value".

The new VwVws achieves a comprehensive harmonisation of the WGK system with the hazardous substances legislation. This will also prevent work from being carried out twice for the substance classification both for the company as well as for the authorities. The classification is also made easier for foreign companies.

Special classifications

Not all substances hazardous to waters can be appropriately classified by R phrases: Some substances toxic to humans are not biologically available via the water path, other substances have characteristics hazardous to waters, such as mobility in soil and groundwater, which are not illustrated by R phrases. For such cases, special classifications might be done by the Commission for the Classification of Substances Hazardous to Waters (KBwS). Otherwise, the responsibility for correct classification of substances lies with the manufacturers and distributors.

To enable a uniform water legislation enforcement, the VwVwS provides for the classification to be centrally collected and published. The Federal Ministry for the Environment has assigned the tasks of this registration and information agency for substances hazardous to waters to the UBA. The up to date classifications documented have been made available in the internet (www.umweltbundesamt.de/wgk.htm).

(IV 2.6)

16. Genetically modified plants: Protection against risks

The legal basis for the release and placing on the market of genetically modified plants in Germany is the *Genetic Engineering Act*, and within the European Union the *Genetic Engineering Release Directive (Directive 90/220/EEC for the deliberate release of genetically modified organisms in the environment)*.

In recent years, it has become increasingly clearer that the Directive should be adjusted to the latest level of experience and scientific knowledge. At the same time, the changed societal framework conditions for genetic engineering in Europe should also be appropriately taken into consideration.

Based on the commission's suggestion for the revision of the Directive in the year 1998 as well as the statement issued by the European Parliament in February 1999 and the suggestion of the German EU Council presidency, the Environmental Council agreed to an amendment of the Directive at its conference in June 1999.

During this phase in which the amendment is prepared, the Federal Environmental Agency (UBA) has produced several specialist contributions which were included in the suggestion of the German presidency. At the same time, the political will of the member states was expressed at the council's conference, that approvals should already take into consideration the future regulations. In December 1999, the joint statement of the council was officially announced.*

Improvements to the EC Directive

The draft provides for a series of new features (see Table 15), which will lead to increased safety and transparency for the consumer, especially for the distribution of genetically modified organisms (GMO).

* At its meeting on 12th April 2000, the European Parliament accepted the joint opinion with 35 amendments in the 2nd reading.

Thus, for example, the labelling and packaging regulations are concretised and regulations are included to be able to trace GMO through the course of their processing to products. It is planned to limit an approval for placing on the market to a maximum ten years, an unlimited extension being possible. During the approvals period, the organisms or products should be subjected to monitoring, to gain data for securing the assessment and to be able to identify unexpected effects. To this end, a monitoring schedule must be submitted with the approvals application.

Environmental risks of genetically modified plants

Growing genetically modified plants has a range of potential risks for the environment and health. Acute consequences can be relatively reliably estimated within the framework of the testing of the approvals documents. However, there continues to be a great deal of uncertainty with respect to the long-term effects. In particular, the following risks must be considered:

The integration of antibiotic-resistant genes in the genome of transgenic plants serves to make them more easily differentiated from non-modified plants. These marker genes have no significance for the actual breeding aim. According to present day state-of-the-art, they can be dispensed with. Antibiotic-resistances in plants are above all disputed because it is feared that they make an additional contribution to the spread of resistant pathogenic (disease causing) germs.

There are ever more resistant bacteria in the environmental media. That is a significant therapeutic problem in human and veterinary medicine. According to present day knowledge, the probability of transfer of the resistance gene of the plant to bacteria, for example in gastro-intestinal passage or during composting, is very low. Nevertheless, a risk regarding the extent of the spread of this property in the environment in large area cultivation cannot be precluded. The resistant genes commonly used are to

Table 15: Amendments to the EC Genetic Engineering Release Directive (90/220/EEC)

Significant Amendments:

- *Limitation of the approvals for placing genetically modified organisms (GMO) on the market to a max. 10 years; limited or unlimited extension possible*
- *Monitoring the GMO brought on the market: submission of a monitoring schedule on application for a permit obligatory.*
- *Participation of the public in all procedures for the release and placing on the market of GMO*
- *Further concretising of the labelling and packaging regulations as well as new regulations concerning the traceability of the GMO*
- *Further concretising of the basic principles for assessing the environmental risk*
- *Possibility of limiting the use of antibiotic resistance genes, which have a human or veterinary medicine significance*
- *Improving the position of the scientific committees in the case of disputed methods for placing on the market (Checking the effects on human health and the environment)*
- *Formation of an ethic committee (general genetic engineering questions)*
- *Closer linking of the product guidelines concerning GMO (e.g. seeds, food) to the release directive, i.e. the regulations concerning GMO in the product guidelines must be equivalent to the regulations in the release directive*
- *Increased consideration of the precautionary principle by inclusion in the determination of the purpose (Item 1) and the general obligations (Item 4) of the release directive.*
- *Possible to change the conditions for placing on the market if new information relevant to the risk is available, in coordination between the EU Commission and the member states*

be assessed differently: The npt-II-gene, which provides resistance against kanamycin, is already widespread in soil flora, and the corresponding antibiotic has virtually no medicinal significance. On the other hand, for example ampicazine, which provides resistance to the npt-III-gene, is an emergency antibiotic.

At the same time, considering the lack of benefit, even low risks should not be taken. The UBA has for years demanded that antibiotic resistance genes be universally dispensed with in transgenic plants, whose release or placing on the market should be approved. The approving authority, the Robert Koch-Institute (RKI), has also adopted this position.

The spread and establishment of genetically modified plants in the environment

The risk of an uncontrolled spread of transgenic plants (or the property integrated in them) is depen-

dent on the characteristics of the recipient plant and the type of genetic modification. The most important cultivated plants are subjacent to wild plants in a natural environment. The approving authorities are to examine whether the genetic modification alters this, i.e. provides an advantage. For example, a pest resistance, in particular the ability to resist environmental resources such as cold, aridness or salt content, improve the ability to survive in the environment and the spread in natural habitats.

However, it must not be the cultivated plant itself which spreads uncontrollably. If the cultivated plant has closely related wild plants it can cross-pollinate with, these genetically imparted properties might be received via the pollen. It is then not the cultivated plant itself, but its wild relative, which possibly has an advantage over competitors. The risk of cross-pollination with wild species is not given in the case of maize stemming from America. On the other hand, it can be proven in the case of rape seed that several hundred metres away from the test cultivation areas hybrids can be found in whose genotype the

genes from the transgenic cultivated plant are integrated. The UBA assigns the ability to spread a very high significance within the framework of the risk assessment, as faulty assessments may have irreversible ecological consequences.

Indirect effects

Growing genetically modified plants can have significant consequences on the growing practice of agriculture: Crop rotation, the way of working the soil, type and quantity of the fertiliser or the use of plant protection products can differentiate from conventional methods. This need not be negative for the environment, say if less insecticide is needed due to growing insect resistant plants. However, the practical experience gained to date, in particular in North America is contradictory: In the case of insect resistant maize, infestation with the European corn borer frequently falls by more than 90 %. Insecticides still have to be used in some cases in spite of this, especially as soon as pests such as the frit fly appear, against which the insect poison produced by the plant is ineffective.

An overall balance from an environmental point of view, in particular for European circumstances, has yet to be produced. Particular attention must be given to the occurrence of resistant pests. Even the biotechnological industry does not deny that this risk exists for widespread cultivation. The question is only, when this happens and how it can be delayed, for example by breeding new strains.

B.t. maize contains a toxic gene from the genome of the bacteria *Bacillus thuringiensis* (B.t.). The resulting resistance imparted based on a specific interaction of a poison (B.t. toxin) with receptors of the insect intestine. The effect is aimed at butterflies, such as the corn borer for example, whose larvae drill into the stems of maize plants and thus lead to very high harvest losses in some cases. In particular, the representatives of biological farming fear the occurrence of resistant pests, because then the *Bacillus thuringiensis* bacteria – as one of the few insecticides used in ecological farming – would lose their effectiveness. The UBA demands that to limit the risk, the cultivation be limited to such areas, in which experience shows that losses of harvest are to be expected due to the corn borer. In addition, the selection pressure on the damaging insects to develop a

resistance should be reduced by resistance management – i.e. by sowing non-transgenic plants on certain areas.

Harmful effects on non-target organisms: the example B.t. maize

In particular, when resistances to pests are imparted by genetic engineering it must be carefully examined whether only the pests are affected or whether other organisms are directly or indirectly involved. This could have considerable consequences for the biological diversity – even in adjacent natural habitats.

The most important example for this is the already mentioned insect resistant B.t. maize. As early as 1997, a Swiss company received a European permit according to the EC Genetic Engineering Release Directive, despite a critical statement by the UBA. This permit for a new type of maize was even then already greatly disputed, in particular because there were significant gaps in the knowledge of the effect on non-target organisms.

As the B.t. toxin is usually produced continuously in all parts of plants, even insects that live on the plant or in the root area – or possibly even species that live in symbiosis with plants – might come into contact with the toxin. The long availability of the toxin could even affect other, higher links in the food chain. In the meantime, information is available that beneficial organisms – such as predatory insects (lacewings), which feed on insects harmed by B.t. toxin, can indirectly also be impaired by the toxin.

The UBA has therefore awarded a research project with the title “Release of *Bacillus thuringiensis* toxin producing plants: Test systems for determining the effects on non-target insects as well as non-target organisms of the soil microflora” to the University of Bayreuth, Animal Ecology Chair II. In this project, the physiological effect of the B.t. toxins from transgenic maize plants on the digestion is to be studied using the example of the plant-eating insect *Chilo partellus* and its parasite *Cotesia flavipes* which attacks the larvae. To this end, feeding experiments will be carried out with the plant pests, initially in the laboratory, to investigate the effect of B.t. maize on these organisms. Subsequently, the indirect effect of the B.t. toxin on the parasitic *Cotesia flavipes* will be in-

vestigated, whose larvae develop into *Chilo partellus* which has been fed with B.t. maize. The project will end in 2001.

To prevent the corn borer larvae from eating the maize, the toxin only needs to be formed in the leaf and stem tissue. This is, however, not the case in most currently developed B.t. types of maize. The poison lies in all parts of the plant, even in the root tissue and the pollen. It must be taken into account that up to 5 per cent of the maize pollen can be transported by the wind into adjacent habitats. Current laboratory tests by American researchers indicate a possible damage to the larvae of the Monarch falter by B.t. maize pollen, if this gets onto the main feeding plant of the Falter, a swallowwort growth. When eating, apart from the food plant, the animals unintentionally also take up the pollen that has drifted there. Numerous butterfly caterpillars were killed.

These results cannot yet be simply transferred to open land conditions, however, they are of great significance. It has yet to be clarified for the main area of use of B.t. maize in Europe too, whether a hazard exists for certain butterflies due to pollen drift. It has not yet been clarified for example in which butterflies the eating activity coincides with the distribution of pollen of the genetically modified maize and whether harmful concentrations of poison can occur on the food plants preferred by the animals due to the pollen of the B.t. maize.

The occurrence and behaviour of butterflies and other non-target insects in the immediate vicinity of fields on which B.t. maize is grown should therefore be observed, in order to be able to identify possible effects at an early stage.

Particular attention must be paid to the risk of pollen drift in the vicinity of protected zones. In Germany, depending on the region and size of the protected zone, 22 to 29 percent of the nature conservation areas are adjacent to or surrounded by agricultural cultivation areas. If the pollen of B.t. maize penetrates such zones, it will be likely that it could affect species of butterflies and possibly other organisms which are on the Red List. The UBA therefore represents the opinion that no B.t. maize should be grown in biosphere reserves and comparable protected zones as well as maintaining a minimum distance from nature conservation areas of 200 metres to protect the

species of butterflies living in these areas. The 200 metre spacing will only be superfluous if it is verified that no toxin is produced in the pollen of the genetically modified maize.

Problems at the roots

A further aspect which has to be more closely investigated is the possibility of the discharge of the B.t. toxin via the root of the genetically modified maize plant and the resulting potential effect on soil organisms. In the meantime, new experimental information is available that maize plants discharge significant amounts of toxin. As the toxin is bound to soil particles, without losing its activity, and is thus protected against degradation over a longer period, this could have significant effects on soil organisms and functions. A research project initiated by the UBA on the "Effect of gene products on the habitat functions of soil" should also deal with this question.

The UBA has repeatedly expressed its doubts about placing on the market genetically modified, insect resistant maize. Risks for the environment and gaps in knowledge were the reasons. Therefore, the Agency has spoken in favour of application limitations for precautionary reasons. Even before this became the European consensus with the new draft of the EC Directive 90/220/EEC, it was recommended that the Europe wide type approvals be limited and combined with monitoring the effects on non-target organisms. In this way, data can be acquired for open questions and if necessary, any harmful effects that occur identified at an early stage and prevented.

Stronger weighting of ecological risks

The arguments of the UBA have also contributed to the decision of the Federal Ministry of Health, in view of the type approval for insect-resistant maize originally planned for February 2000 to instruct the RKI that the approval for the placing on the market of this type be put on ice for an indeterminate time where growing is concerned. At the same time, the appeals procedure in accordance with Article 16 of the EC Genetic Engineering Release Directive 90/220/EEC has been initiated. Similar measures have already been taken by France, Austria, Portugal, and Luxembourg.

The proposed amendments to the EC Directive 90/220/EEC have already led to more attention being paid to the ecological risks of genetically modified plants when approving the placing on the market than in the past. This is also reflected in the fact that where possible, when deciding about an approval, the RKI should involve and obtain the approval of the UBA and the Federal Biological Agency (BBA).

(IV 2.5)

17. The power of the market: Product-related environmental protection

Improvements to the environmental properties of products remain an important field of action for environmental policy. The aim is to motivate companies to bring more products onto the market which, due to their method of manufacture and through their utilisation, contribute to save resources and reduce pollutants. In the same way, the consumers must also be given stimuli to consciously demand "ecoefficient" products and to use them in an environmentally oriented way.

Interpretation in Life Cycle Assessment

The instrument of Life Cycle Assessment (LCA) has proven particularly effective for improved assessment of optimisation approaches to product-related environmental protection. LCAs enable products to be compared with respect to environmental protection and to point out weak points and possibilities for optimisation. Internationally binding standards have been introduced which have led to a higher quality and comparability of the results. One problem remains, namely summarising the many-layered results of a LCA to a final statement. Here can frequently be observed that commissioners of LCA studies subsequently summarise the meticulously collected results due to their lack of clarity depending on their interests, to produce the desired end statement.

A methodical framework is required to counteract such an interests-oriented approach in the assessment of ecobalance results. It should enable the large amount of individual information (for example contributions to the greenhouse effect, to acidification) to be transparently and clearly summarised.

Such a weighing-up process cannot be based on natural scientific knowledge alone; it is far more dependent on a large number of value standards. The problem is in linking objective natural science knowl-

edge with subjective values and to develop an overall assessment from this.

To this end, a method has been developed by the Federal Environmental Agency (UBA) for the Interpretation in LCA. In this method, the problem of subjectivity is taken into consideration as the necessary weighing up of the significance of different environmental aspects takes place in an assessment panel independent of a practical ecobalance. The decisions of this assessment panel are not based solely on the subjective values of the participants, but take into consideration the knowledge about certain environmental effects of the cause-effect relationships.

A core item of the method is the ranking of the various effect categories incorporated in an ecobalance. The following stipulations were made:

A category or a certain impact indicator result is assessed more environmentally damaging and is given a correspondingly higher priority,

- The more serious the potential hazard to the safeguard subject is to be considered in the impact category concerned, independent of the current environmental status ("ecological hazard")
- The further the current environmental status in this impact category is removed from a condition of ecological sustainability or another strived-for environmental status ("distance to target")
- The greater this effect indicator result is in relation to uniform reference values, for example the proportion of the respective total annual emissions in Germany ("specific contribution").

The task of an assessment panel is to rank the available information to impact mechanisms, environmental quality targets and current environmental status of the respective impact categories. A specific category is therefore given a higher ecological priori-

ty than another. While the specific contribution represents a calculable dimension, the ranking means a subject assessment by the assessment panel with respect to the two other criteria which are therefore not generally valid.

In a concrete LCA, it is then possible to weigh the results up against each other which have been calculated in the individual effect categories with the aid of the previously stipulated ecological priorities.

Life Cycle Assessment (LCA) for papers

One of the first applications for the UBA interpretation method was the research project "LCA for graphic papers".

The following questions were of particular interest:

- Is the use of recycled paper as a fibrous material for the production of printed newspapers, magazines and photocopy paper more favourable under environmental aspects than the use of wood as a raw material?
- Should printed products preferably be re-used in the paper industry after use or energetically recycled or disposed of as waste?

The result of the LCA: A high waste paper return rate of 76 % is significantly more favourable under environmental aspects than an average waste paper return rate of 69 %. The latter is in turn much more favourable than a low waste paper return rate of 57 %. From this result, which was confirmed by sensitivity scenarios, the UBA deduced the recommendation that the level of recycling used graphic paper materials attained in the paper industry should be maintained. Under environmental aspects, paper recycling therefore has priority.

The research project was awarded as a joint project to be carried out by the Institute for Energy and Environmental Research (Ifeu), Heidelberg, together with the Office for Applied Forest Ecology (BaWÖ), Duvensee, and the Institute for Environmental Information Technology (IFU), Hamburg, Dr. R. Stern, Berlin and the Institute for Environmental Protection of the University of Dortmund (INFU). As a special methodical feature, the attempt was made for the first time to take into consideration the use of regenerative resources (forests) using a newly defined effect indicator "habitat loading".

Advantages of combustion

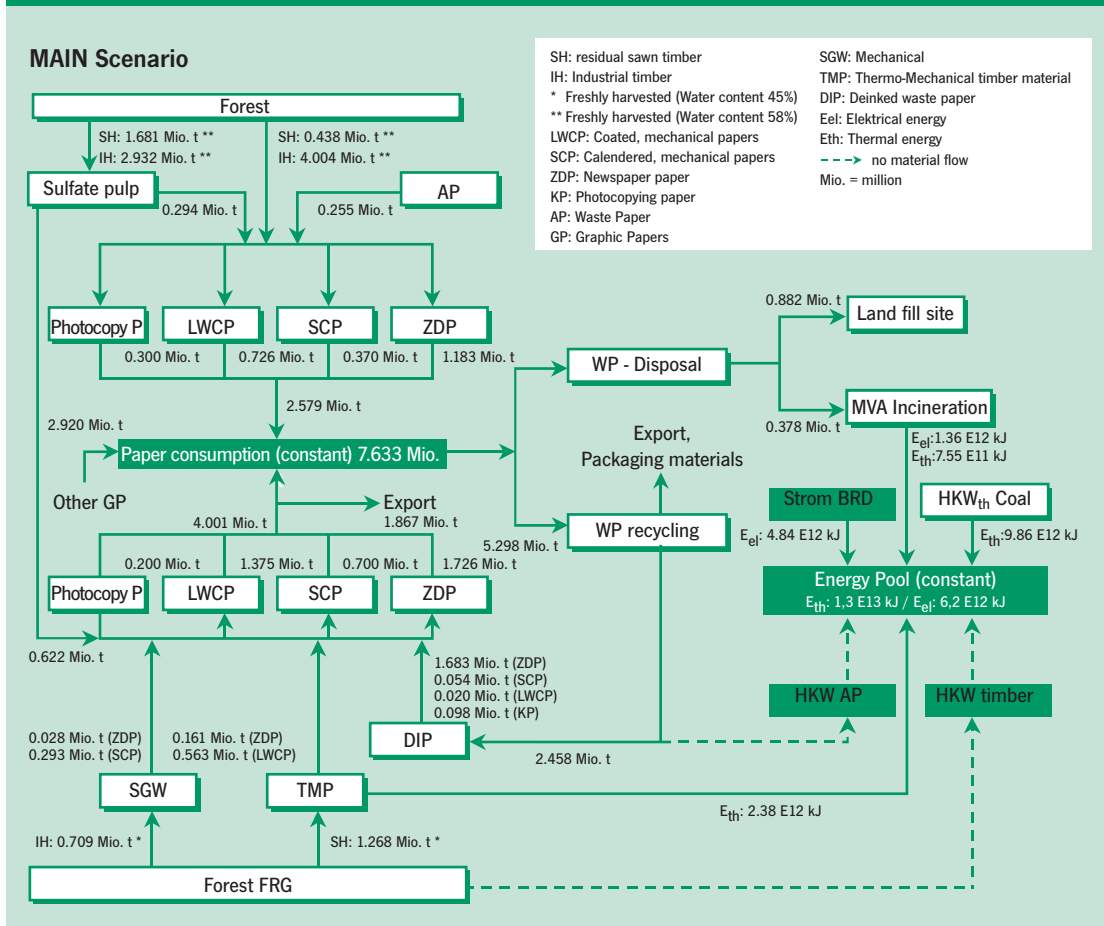
From a technical point of view, saturation tendencies can be determined in the recycling of waste paper in Germany. Therefore, on average, the waste paper-recycling rate will not be able to significantly increase above the present level in the long term. In future, however, due to the effects of the *Technical Instruction on Municipal Waste (TASi)* as well as the planned *Ordinance for the Environmentally Compatible Storage of Household Wastes (AbfAbIV)* a decrease in the amount of waste paper disposed of in land fill sites is expected. What should be done with the surplus quantities of waste paper which for capacity reasons are not used as recycled materials?

Result: Based on the results of this Life Cycle Assessment, for reasons of environmental protection, in future this surplus quantity of waste paper should preferably be burnt in power-heat coupled plants of the paper industry. For the case that a separated collection of the surplus paper quantities for purposes of combustion is not possible and in future the total residual waste initially has to be pre-treated in domestic waste incineration plants, mechanical-biological treatment plants (see Chapter 18) or other plants due to the regulations of the TASi as well as the planned AbfAbIV, the LCA results provide the following conclusion: From an environmental point of view, it is somewhat more unfavourable to leave surplus quantities of waste paper in residual waste than to use the alternative of recycling it in power-heat coupled plants of the paper industry. In both combustion options, the combustion of surplus quantities of waste paper should preferably replace coal-fired power stations.

Overall, all waste paper combustion options are significantly more favourable under environmental protection aspects as the disposal of the waste paper in landfill sites which should also be ceased due to its significantly high potential of increasing the greenhouse effect.

Comparison of the sole use of waste paper as a raw material for the production of paper for newspapers and photocopy papers with the use of timber as a raw material leads to the result that newspaper and photocopy papers made from waste paper are much more environmentally friendly.

Figure 15: Material and energy flows in the LCA
(very simplified illustration of the over 100 processes investigated)



Comparison of the proportional use of waste paper (30 %) as a raw material for the manufacture of coated (LWC) and of super calendered (SC) paper with sole use of timber as the raw material shows that the coated and super calendered paper made of waste paper perform much better.

Summarising, the study recommends that all measures which have contributed to the high level of recycling of graphic papers reached today of around 80 % must definitely be retained. This also includes

the resolution of the German Bundestag of 1992 to primarily use recycled paper for administrative purposes. Furthermore, the pulp and paper works concerned should continue to aim for a high level of state-of-the-art to reduce the discharge of pollutants.

However, the consumers should also not be forgotten, who through their behaviour can contribute to economical use of paper in many places.

(III 2.5)

18. Sustainable landfill management

In conjunction with the concretisation of the Technical Instruction on Municipal Waste (TASi) with respect to mechanical-biological waste treatment (MBA), it was again confirmed that the landfilling of domestic wastes was not sustainable. It should therefore be ceased.

In November 1998, the 51st Environment Ministers' Conference (UMK) requested that the "possibility of deciding between competing (waste) treatment methods continue to be secured" based on the "high ecological requirements of the TASi". In addition, the coalition agreement of the Federal Government also contains the information that "ecological aims of the waste industry should be pushed forward, including mechanical-biological methods". These methods must also fulfil the prerequisites of sustainable materials management.

To be able to assess how far alternative waste treatment methods were ecologically justifiable, the objective of treatment was first subjected to a methodical critique.

The aim of the pre-treatment of wastes prior to final storage is as far as possible to completely reduce the hazards emanating from waste constituents. Two main paths are taken to reduce the potential hazard from the materials:

- **Passive hazard reduction.** The substances are removed from the biosphere and stored in places in which they are practically no longer bio-available (for example, closed landfill sites with landfill gas and seepage water treatment, underground landfill, mining fill). To achieve this, the transport routes for the release of pollutants are interrupted (seals, geological barriers) and transport media are reduced or completely precluded (seepage water, gas formation).
- **Active hazard reduction.** The substances are converted into less hazardous substances which have a reduced, clearly reduced or no ecotoxicological potential (inherently safe) (for example mechanical-biological waste treatment

and thermic waste treatment through to high temperature processes with extraction of a molten slag) using chemical, physical or biological reactions.

With respect to the **active** reduction of hazards, the processes

- Mechanical-biological waste treatment (MBA) with subsequent waste storage and
- Waste incineration (MVA) with subsequent waste storage

do not have the same value because persistent organic substances cannot be degraded in biological treatment plants. The biological treatment process has a principle, methodical limit. This also applies to the applied biological waste air purification measures of the MBA used to date. However, further reaching waste air purification technology is available from other environmental sectors, for example the hotbed process.

To improve information about the alternative methods of waste treatment using "Mechanical-biological waste treatment with subsequent storage of the residual wastes", the results of an 18-part combined project were assessed which the Federal Ministry of Research funded with 15 million DM. In addition, additional knowledge was gained from pilot projects on a true scale, which were partially financed by the Länder (States).

In the required ecological comparison of the two process lines for "preliminary waste treatment with storage", substances and emissions

- With any number of (almost infinite) waste constituents;
- Any number of auxiliary substances, metabolites;
- Any number of undesirable effects and
- Any number of target organisms

and the on the level of the

- Cells,
- Organs,
- Organisms,

- Populations and
- Biocoenoses

on their damaging ecological effect during the treatment and during storage had to be assessed and compared with each other. In addition, there are countless interactions which overall make it impossible to determine an ecological equivalence.

It was therefore examined which additional requirements had to be made of the MBA, the landfill facility, the landfill operations, and the waste properties to enable the waste air and wastewater emissions to be as low as for the “thermal pre-treatment of residual wastes with subsequent storage”. To do this, the emission freights were first determined along the whole materials flow – from entry to the treatment plant (MBA and MVA) through to the final storage. In a second stage, the additional requirements were formulated which are necessary to achieve similarly low emission freights using the treatment method “MBA + storage” which are already reached today using the state of the art treatment method “MVA + storage”. To determine the emission freights along the waste treatment path, the waste air emissions in accordance with the *Seventeenth Ordinance on the Implementation of the Federal Immission Control Act (17th BImSchV)*, the wastewater emissions in accordance with Appendices 47 and 51 of the *Wastewater Ordinance* and the storage conditions as well as the materials-specific waste properties were determined using the TASI. Table 16 (page 90) lists the additional requirements of the MBA with subsequent storage which lead to similar emission freights as along the process route “MVA + Storage”. In the UBA report of July 1999 on the ecological justifiability of the mechanical-biological pre-treatment of residual wastes including their end storage, the principal limits of the ecological comparability are shown and the waste treatment method measured against the standard of “ecological justifiability” in the following sequence of assessed values:

1. Thermic waste treatment

The significant principal advantages of thermal end treatment as opposed to a biological final treatment are:

- More advanced material destruction
- Lower waste volumes
- Lower waste air emissions
- Lower seepage water loads
- Lower gas formation in the stored residual wastes
- Improved compatibility of the residual wastes and thus reduced settlement of the landfill site.

The UBA therefore recommends that the state-of-the-art (waste incineration) prescribed by TASI be replaced by a binding ordinance.

2. Biological-thermal combination method without direct storage

In combination methods without direct storage (mechanical-biological treatment, MBA of the waste before thermal treatment, for example dry stabilate methods) it can be seen that “ecological aims in the waste industry can be implemented, which include mechanical-biological methods” (SPD/Green Party coalition agreement). The allocation criteria of the TASI are complied with. These methods do not contradict the resolution situation of the 51st German Environment Ministers’ Conference (UMK). Merely the existing legal regulations (*4th and 17th BImSchV, AbwV, TASI*) have to be extended and concretised to include mechanical-biological waste treatment plants.

Combined methods linking the advantages of biological-mechanical waste treatment with the advantages of the thermal destruction of biologically non-degradable substances, can already today lead to complete recycling of municipal solid waste in an economical manner. They are principally suitable as the final link of sustainable materials management in which each generation solves their own material (waste) problems themselves and subsequent duties of care for stored waste over several generations are principally avoided.

Methods using the thermal final treatment of substances can be used individually or in combination with “mechanical-biological waste treatment without direct final storage” to lead to practically complete recycling of municipal solid waste. The principally unsustainable storage of waste in landfill sites can be overcome in the medium term using these waste treatment methods.

Table 16: Requirements for mechanical-biological waste treatment with subsequent end storage

Requirement	Explanation (see text also)
1 Waste air, mechanical-biological waste treatment (MBA)	
Freight limitation to 55 grams per tonne waste	Similar to low air emission freights as for MVA C (17th BImSchV); 55 grams C per tonne waste MBA (with biofilter); approx. 300 grams C per tonne waste
Containment and treatment of waste air from rotted waste from conversion processes or AT4 < 20 mg O ₂ /g TS before discharge in the rotted-waste Waste air chimney Stipulate waste air germ status	Similarly low air emissions freight as for waste incineration (MVA) Immissions-related regulation (17th BImSchV, TA Air) Infection protection, distance from buildings
2 Wastewater	
Wastewater free operation	Limitation of the emissions freight via wastewater as for MVA (Wastewater Ordinance, Appendix 47)
3 Parameters of the TA for Household Waste	
All parameters of Appendix B of the TA Household Waste for Landfill Class II must be observed	Protective targets of TA Domestic Waste separation of rich-calorific fractions
Different from the allocation criteria of the Appendix B applies to treatment residues from the MBA:	Climate protection through substitution of fossil fuels, low settlement in the landfill site
No. 2 Organic component of dry the residue of the original substance:	High compatibility of the wastes on the land fill site the same TOC freight in leachate as in wastes which just comply with the TA Household Waste allocation criteria
No. 2.01 Determined as ignition loss: 30% mass (Instead of 5% mass)	
No. 2.01 Determined as TOC: 18% mass (Instead of 3% mass)	
No. 4 Eluate criteria	
No. 4.03 TOC (eluate) 200 mg/l (instead of 100 mg/l)	
If the following additional requirements are fulfilled: Respiratory enzyme, determined over 4 days in laboratory test AT4 < 5 mg O ₂ /g TS (BMBF Combined method) Gas formation, determined over 21 days in laboratory experiment BG21 < 20 l/Gas/g TS Low water permeability of the waste body, permeability coefficient $k_f > 10^{-8}$ m/s Water content less than the optimum Proctor water content ($w > w_{pr}$) Sieve section < 40 mm (particle size)	Low biological activity (Low gas formation in the landfill site) Low biological activity, Control value for low gas formation on the landfill site Little leachate
Built up of highly compacted thin layers, installation density > 95% Proctor density Open installation area < 5% of the total area Installation only during dry weather periods (seepage water minimisation), i.e. if necessary intermediate storage of the MBA treatment residues until covered landfill installation 5-10% cross fall for each day's formation Only unavoidable end storage of the wastes on Class II landfill sites or old landfill sites, which fulfil the technical requirements of the TA for Household Waste Reduction of the methane emissions by oxidation, e.g. in the recultivation layer	No press water, free aeration ways for the low landfill gas development Low settlement, low seepage water formation, due to high compatibility Low settlement, low water permeability, low area required for landfill sites Little leachate Little leachate, preset water content, free aeration paths
Quality Assured Monitoring	Rapid runoff of rainwater, low seepage water formation No mixing, therefore no reaction with other wastes Reduction of the emissions on the gas path
	Securing enforcement

3. Combination methods with materials flow specific waste treatment

In the case of combination methods with materials flow specific waste treatment, i.e. in which following mechanical separation, a biologically treated waste fraction is provided for storage and a rich calorific light fraction for thermal treatment, "ecological aims in the waste industry can also be implemented", with the limitation that supplementary and modified requirements have to be made. The requirements must be oriented to aim for low emissions and subsequent landfill according to the TASI.

As long as the real emissions in the existing landfill sites are virtually independent of the respective preliminary treatment, it is principally justifiable, albeit not absolutely necessary, to permit mechanical-biological waste treatment with additional requirements for waste air and landfill operations for a limited period. After shutting down the old landfill sites and after exhausting the then still available capacities in landfill sites which by then fulfil the requirements of the TASI, mechanical-biological methods are only justifiable together with thermal treatment methods, the combination of which must not lead to storage of municipal solid waste.

4. Direct storage of all MBA residues

In "mechanical-biological waste treatment for subsequent final storage of the treated MBA residues", the Coalition's intentions are **not** implementable within the framework conditions of the UMK resolution.

A permanently environmentally compatible waste industry only fulfils the prerequisites for sustainable materials management, if the material environmental problems will not be solved at the expense of subsequent generations. Concepts which principally require subsequent care of more than 100 years do not fulfil the prerequisites of sustainable materials management.

In August 1999, the Federal Ministry for the Environment published an outline paper for the future disposal of municipal solid waste which foresees the end of unsustainable landfill management by the year 2020. By this time, materials specific MBA with subsequent final storage will be tolerated. The environmentally relevant requirements (see Table 16)

should be implemented in the following three ordinances:

- Requirements for waste air treatment in MBA plant: *29th BImSchV*
- Requirements for the discharge of wastewater from MBA plants: Appendix 59 of the *Wastewater Ordinance* to § 7a WHG
- Requirements for the waste quality to be stored and for the installation conditions for the landfill: *Ordinance for the Environmentally Compatible Final Storage of Municipal Solid Waste.*

(III 3)

Part 2:
Part 2:

Project results, data, and news:
A glimpse on the work of the UBA
**Project results, data, and news:
A glimpse on the work of the UBA**

Department I: Environmental Planning and Environmental Strategies

Division I 1:

Environmental Strategies and Environmental Information

Virtual Environment

The Federal Environmental Agency developed the environmental presentation system "environment germany" in connection with the World Exhibition Expo 2000 in Hannover. It uses multimedia to present the

- State of the environment
- Environmental problems
- Approaches used for solutions and
- Successes of the measures in Germany to date

"environment germany" is available as a CD-ROM as well as in the internet (<http://www.environment-germany.net>). (I 1.1)

Environmental Research Plan UFOPLAN

The Environmental Research Plan (UFOPLAN) of the Federal Ministry for the Environment (BMU) promotes applications-oriented research. In 1999, the focus of the projects – in rounded up proportions of the whole research budget of the portfolio – were (the figures for 1998 are given in brackets):

- Fundamental environmental policy issues 20 % (20 %)
- Water industry, water protection 12 % (12 %)
- Soils protection, rehabilitation of contaminated sites 5 % (8 %)

Detailed reports and background information is available on many of the topics, some of which in English as well. All orders from outside Germany may be directed to the Central Reply Service of the UBA, Bismarckplatz 1, 14193 Berlin, Germany. Fax ++49-30/89 03-2912. A list of all UBA publications is also available from here, free of charge.

- Climate protection, Air quality control, Plant safety 17 % (14 %)
- Noise protection, Noise abatement with around 4 % (5 %)
- Environmental effects on human health and ecosystems, Chemicals safety 20 % (13 %),
- Recycling and waste management 8 % (5 %),
- Nature conservation, ecology 4 % (5 %) and
- General environmental protection issues 11 % (19 %). (I 1.1)

Sustainable Germany

By spring 2001, the UBA's study "Sustainable Germany", which has met with a broad positive response, will be continued. The following new topics have also been included:

- Buildings and housing
- Production
- Instruments and institutions. (I 1.1)

International Visitors

In 1999, numerous international guests visited the UBA. The groups came from 18 countries, most of them from Japan, China and Korea. Guests from all over the world, especially from Central and Eastern European states participated in conferences, workshops and seminars. These events took place in Berlin, Hamburg, Schwerin, and Bonn. A list is obtainable from unit I 1.2. (I 1.2)

European Environment Agency

The European Environment Agency (EEA) produced, inter alia, the Report on the State of the Environment in Europe. The UBA was involved in the preparation of the report, not only as the German National Focal Point (NFP) for the EEA but also with the German National Reference Centres (NRC) based in the Agency. The report "Environment in the European Union at the Turn of the Century" is published by the EU's Office for Official Publications, Luxemburg, and is available in bookshops (ISBN 92-9157-202-0). (I 1.2)

Agenda 21 for the Baltic Sea

At the meeting of the Baltic Sea Council from 22nd to 23rd June 1998, the foreign ministers of the abutting countries on the Baltic Sea passed the Agenda 21 for the Baltic Sea region. (<http://www.ee/baltic21>).

(I 1.2)

Environmental Action in Eastern Europe

The Ministers' Conference "Environment for Europe" in Lucerne 1993, initiated two international forums to support the Environmental Action Programme for Central and Eastern Europe (EAP):

- The Project Preparation Committee, PPC, which is based at the European Bank for Reconstruction and Development (EBRD) in London (<http://www.ebrd.com/english/enviro/ppc>).
- The EAP Task Force with secretarial head office at the Organisation for Economic Cooperation and Development (OECD) in Paris (<http://www.oecd.org/env/eap/aarhus.htm>)

The EAP Task Force assists the Central and Eastern European States (MOE) and the New Independent States (NUS) with the set up of environmental institutions. The focal topics are the implementation of national environmental action programmes, financing for environmental protection and environment-oriented management in companies. The PPC sponsors specific investment projects.

Germany is a member of both committees. The UBA is responsible for the coordination of the activities, for the preparation and follow-on work for meetings as well as for research projects. (I 1.2)

Environmental Labelling in Tourism

The UBA suggests that a uniform, umbrella environmental symbol be developed for tourism. This should finally bring the discussion process on environmental quality labelling of touristic products, which has now lasted almost ten years, to a successful conclusion. The very conflicting interests within the tourism business have prevented an agreement being reached on a suitable catalogue of criteria. Therefore, in 1999, the UBA developed a concept which suggests a two-stage approach: First, a board of directors must be set up. Only after a consensus has been reached within this "umbrella symbol group" regarding organisational questions such as award, control and financing,

should reliable, transparent criteria, capable of receiving approval from the majority be produced in a second stage. The umbrella symbol group met in October 1999 for their constituent meeting. The reaction of the parties involved has been positive to date. (I 1.2)

Tourism "yes" – Ecology "no"?

Even the players in the tourism business – in the meantime one of the most important branches of industry in Germany and worldwide – barely dispute it: Touristic development falls a long way short of being sustainable – i.e. permanently environmentally compatible. This has consequences, not only for the whole of society, but also for the tourism business itself. In this way, it is using up its own existential base. Against this background, on the occasion of the International Tourism Exchange in Berlin in March 1999, trends in tourism, their effects on the environment and the implementation of sustainable tourism were discussed. Current travel trends can be summarised boldly and simply as "quick, frequent, brief trips to as remote as possible destinations". The intensified traffic, growth in accommodation and gastronomy as well as the ever extremer leisure activities lead to increased pollution, degradation of landscape and surface sealing. In addition, this is exacerbated in many places by excessive water consumption of the holidaymakers in areas with scarce drinking water resources, inadequate purification of the wastewater as well as an over proportional waste production with improper disposal.

"Environmentally conscious tourism" has not yet become a mega-trend. Environmentally oriented travel products frequently face an image of deprivation and boredom. Professional communication strategies are required showing sustainable alternatives and applying the term "environmental protection" in a positive sense in the tourism sector.

The conference documentation is available from Section I 1.2. The study "Mega-Trends im Tourismus" (TEXTE 99/98) is available from the Central Reply Service. (See the info box on page 94). (I 1.2)

Internet Presence

The UBA internet site (<http://www.umweltbundesamt.de>) was rapidly extended during 1999 and the graphics redesigned at the end of the year. By the end of 1999, the information on offer included al-

most 7,000 files with a total 180 Megabytes of data. This equates to almost two hundred files full of DIN A4 pages. Almost 1.7 million visits were made to the site. (I 1.3)

Scientific Publications

In 1999, the UBA published over 120 scientific publications (BERICHTE Series: Seven titles, TEXTE Series: 90 titles, publications outside of the UBA series: 25 titles). The development is shown in Figure 16.

A precise overview of the titles is available free of charge from the Central Reply Service. (Address page 94).

Consumer-oriented Publications

In 1999, the UBA also produced new consumer-oriented publications. The most popular brochures and leaflets include topics like:

- "An environmentally conscious lifestyle"
- "Environmental data, Germany 1998"
- "Your loss – energy thieves in your home"
- "Saving energy in the home"
- "Municipal heating expenses"

Health Resorts with a Curative Climate

Health resorts of Germany with a curative climate are characterised by the high quality of their environment. These tourism locations should be given a guide within the framework of a research project. It should assist them to preserve these essential service components. At the same time, it lists positive examples and helps to avoid mistakes that have been made elsewhere. *The guide, "Premium Class – Eine Handlungsanleitung für Heilklimatische Kurorte" (Instructions for action by curative climate health resorts) is available from the Association of Curative Climate Health Resorts in Germany, 78141 Schönwald, Telephone ++49-7722/86 08 60. (I 1.2)*

Environmental Protection in Do-It-Yourself-Stores

Together with one of the largest DIY chain stores, the Federal Environmental Agency organised an infor-

mation campaign for the "Blue Angel" environment label. The project focussed on informing consumers directly by advisory discussions as well as brochures at the point of sale. Over ten thousand customers took part in a competition. (I 1.3)

Central Reply Service

In 1999, the number of enquiries reached the highest level in the history of the UBA at almost 117,000. The increase compared to the previous year mainly arises from the large increase in inquiries via the internet (over 25,000 enquiries). Over 25,000 visitors were registered to the visitor's centre in the UBA headquarter at Berlin's Bismarckplatz. *The address of the Central Reply Service: Umweltbundesamt, Zentraler Antwortdienst, Bismarckplatz 1, 14193 Berlin. (I 1.3)*

Participation in Trade Fairs

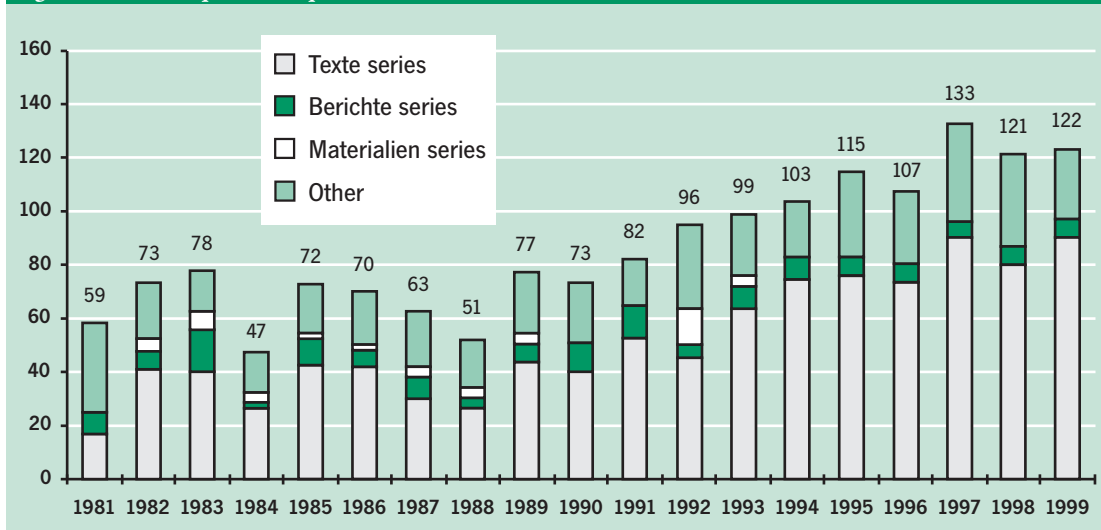
In 1999, the UBA took part in numerous specialist trade fairs at home and abroad. A selection:

- Dynamic World Business Fair, 28th to 30th January 1999 in Nagoya (Japan). Theme: The "Blue Angel" Environment Label
- TECHNOGERMA, 1st to 7th March 1999 in Jakarta (Indonesia). Theme: Sustainable development – examples from Germany
- IFAT, 4. – 8.5.1999 in Munich. Theme: Digital Information Media
- Nature-Man-Technology, 18th to 21st September 1999 in Erfurt. Theme: Digital Information Media
- TECOMEX, 19th to 24th September 1999, Mexico City (Mexico). Theme: Sustainable and Rational Use of Water
- German Technology Symposium & Exhibition, 9th to 13th November 1999, Bangkok (Thailand). Theme: Sustainable development – examples from Germany

Supporting Associations and Environmental Advice

On behalf of the Federal Ministry for the Environment, the UBA financially supported forty different projects carried out by 27 environment associations throughout Germany with a total financial volume of 2.6 million DM. 21 environmental advisory projects were financed with a total of 1.7 million DM.

Figure 16: Development of publications, 1981–1999



Working Groups on Agriculture

Germany took over the management of the Working Group on Agriculture at the HELCOM (Helsinki Commission). UBA Division I 1.4 is the secretariat. The working group should help to reduce the discharge of nutrients from agricultural sources into the Baltic Sea.

The UBA is also participating in the Working Group on Nutrients and Eutrophication (NEUT) of the PARCOM (Paris Commission). The aim is to reduce the discharge of nutrients from agriculture into the North Sea and the North East Atlantic.

The UBA Division I 1.4 (environment and agriculture, food industry) represents Germany

- In the “Task Force on Acidification of Rivers and Lakes” of the UN Economic Commission for Europe (UN ECE)
- In the working group of the Organisation for Economic Cooperation and Development (OECD) for Agricultural Environmental Indicators (Joint Working Party of the Committee for Agri-Environmental and the Environment Policy Committee)
- In several working groups of the European Union.

(I 1.4)

Report on the State of the Environment 2000

To make the Daten zur Umwelt (“Environmental Data 2000”, DzU 2000) report more streamlined and uniform, for the first time the UBA developed a man-

ual based on the “International Guidelines on Environmental Reporting” of the European Environment Agency (EEA). It collates the necessary descriptive and assessment characteristics for around 200 environmental topics and gives the relationships between adjacent topics for integrated environmental considerations. The manual is included in the electronic version of the DzU 2000, as it contains further information (legal and assessment principles, details of additional literature, links between related topics), which cannot be taken into consideration in the printed version.

(I 1.5)

Coordination of International Cooperation

National environmental state of the environment data are increasingly required for environmental reporting of international organisations. In 1999, the UBA participated in working groups of the Statistical Office of the European Union (EUROSTAT), the Organisation for Economic Cooperation and Development (OECD) as well as in the environmental information and observation network of the European Environment Agency (EEA) for the harmonisation and continued development of data principles. In addition, the UBA coordinated the German contribution to two reports of the EEA: the report “Environment in the European Union at the Turn of the Century” (published in July 1999) and the first Environmental Indicator Report of the Agency.

(I 1.5)

Division I 2:

Legal, Economic and Social Science Aspects of Environmental Affairs, Energy

The Environmental Code

For the Environmental Code project, Prof Hans D Jarass, University of Münster, examined questions of the legislative competence of the Federal Government. Against the background that the Federal Government has only powers of framework legislation for matters concerning water management and nature conservation, the possibilities of federal legislative regulations were presented in detail. (I 2.1)

Industrial Installation

Approval law for industrial plants as a centrepiece of environmental legislation was investigated in a research project by Schitag Ernst & Young and a supplementary research team. The empirical study showed that the existing law has proven to be mostly worthwhile. Suggestions for improvements are above all developed for process management. *The publication Erfahrungen mit umweltrechtlichen Genehmigungsverfahren ("Experiences with environmental legislation licensing procedures in three locations") is currently being in preparation.* (I 2.1)

Environmental Legislation Monitoring

One research project sounds out the possibilities of transferring the environmental legislation monitoring of plant to insurances. To do this, Prof Gerhard Hohloch investigated the practice in Great Britain and the USA. He finally assessed the transfer of such monitoring models to Germany sceptically. *The study Übertragbarkeit von Inspektionstätigkeiten ("Transferability of Inspection Activities to Insurers", TEXTE 99/82) is available from the Central Reply Service (page 94).* (I 2.1)

Perspectives for Environmental Rules

On 30th September 1999, the symposium "National and International Perspectives for Environmental Rules" was held at the Federal Environmental Agency. The occasion was the retirement of the long-serving Head of Department I: Environmental Planning

and Environmental Strategies, Prof Peter-Christoph Storm. It dealt with questions of national, European and international arrangements for environmental rules using legislation. (I 2.1)

Material Flows Legislation

On 15th October 1999, an expert discussion on the research project "Material Flows Legislation" was held at the UBA with experts from science, administration and industry, in which the results of the study by Prof Edmund Brandt from Lüneburg were discussed. It shows that in particular, the justification of the materials flow approach requires further attention.

A further research project is closely associated with this topic: "Life Cycle Assessments as Instruments of Environmental Legislation". The author, Prof Eckard Reh binder, Frankfurt, deals with both the definition and methodology of eco-balances as well as with their use and possible further instrumentalisation in environmental legislation. (I 2.1)

Hazardous Substances

With respect to risk reduction for hazardous substances, a research project of Prof Gerd Winter, University of Bremen, investigates how the risks-costs analysis prescribed by the *EC Existing Chemicals Ordinance* can be incorporated into the established need for regulation in appropriate risk reduction measures.

The study "Weighing up Risks and Costs in European Chemicals Regulation" compares theory and practice in the Anglo-American and European regions gives concrete instructions for action. Thus, whenever the prerequisites are given, a cost effectiveness analysis (KWA) should be carried out. Only in the case of remaining higher costs of the selected variant – and only then – is the measure to be undertaken with a weighing up of the ecological benefit. The qualitative assessment process is also given preference. The study (*BERICHTE 99/7*) is available from the Central Reply Service. (See info box on page 94) (I 2.1)

Self-Regulation

In recent years, cooperative forms of action have gained importance as a supplement to statutory rules and prohibitions. This is taken into account by

the research project "Self-obligations and agreements that replace legislation as instruments of environmental protection". Dr Jürgen Knebel, Prof Lutz Wicke and Dr Gerhard Michael, Institute for Environmental Management, Berlin, produced the framework conditions and the efficiency of self-regulation for environmental protection from a legal and economics point of view. The study offers detailed assistance to determine in which situation and with what arrangement self-regulatory agreements represent a promising way of protecting the environment. *The study (BERICHTE 99/5) is available from the Central Reply Service.* (I 2.1)

Competence Distribution in the EU

The research project "Analysis and Recommendations for Action to Realise the External Competences of the European Community and the Member States in the Environmental Sector" which was produced by Prof Walter Frenz, University of Aachen, investigates the competence distribution between the European Union and the member states in negotiations for international agreements. (I 2.1)

Environmental Offences

In 1998, around 47,900 environmentally relevant offences were uncovered in Germany (1997: around 46,000; 1996: around 45,600 offences). This gives an increase of 3.8 % compared to 1998.

These figures arise from assessments made by the Bundeskriminalamt and the Federal Statistical Office which produce a nationwide comparison of environmentally relevant criminal statistics from data of the State Offices of Criminal Investigations and the State Statistical Offices.

Most offences have been committed in the area of unpermitted handling of hazardous wastes with 75.3 % (31,172 cases), followed by water contamination with 15.2 % (6,289 cases). The third most frequent offence is, as in the previous year, soil contamination with 4.9 % (2,024 cases) (see figure 17, page 100).

Apart from infringements according to the 29th section of the Penal Code (StGB), 66 cases of other environmentally relevant paragraphs were uncovered: 21 cases concerned the preparation of an explosion or radiation offences (§ 310 StGB), 8 cases the re-

lease of ionising radiation (§ 311 StGB) as well as 37 cases of the risk of poisoning the general public and negligent risk to the public (§ 314 StGB, § 320 StGB old version).

In addition, in 1998 there were 5,589 offences against secondary environmental laws – concerning nature conservation, animal protection, hunting and plant protection with an increase of 0.9 % (1997: 5,642 cases). Furthermore, 859 offences according to the Chemicals Act were uncovered. The is an increase of 72.5 % (1997: 498 cases).

In the whole Federal territory, the clearing-up rate is 56.7 %. Saxony Anhalt led the way with a clear-up rate of 79.5 %, followed by Bavaria (75.0 %) and Baden-Württemberg (70.7 %). Berlin had the lowest clearing-up rate with 15.8 %. (I 2.1)

Foreign Markets

A new manual provides information about all the important aspects of the export of environmental goods and services from Germany. There is an overview of state-funded grants, an overview of the demand for environmental protection goods and services to the most important foreign markets and many practical hints for developing markets abroad. *ERM Lahmeyer International: "Fördermaßnahmen zur Erschließung von Auslandsmärkten" was published by Erich Schmidt Verlag, Berlin, and is available from bookshops (ISBN 3-503-04882-0)* (I 2.2)

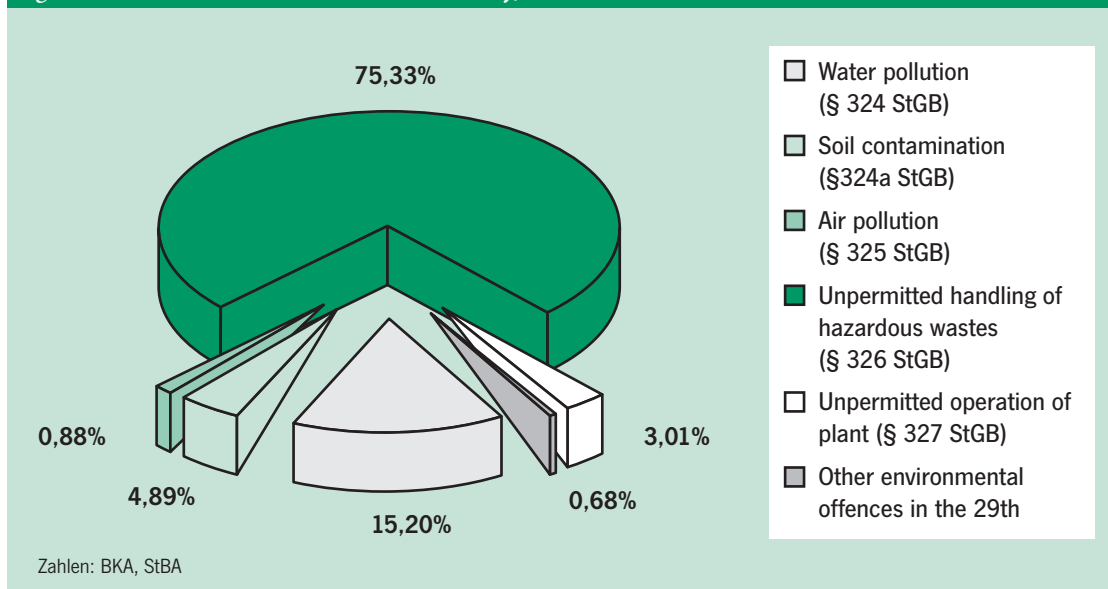
Eco-Tax

The study "Requirements for an Ecological Tax Reform" shows how the introduction and increase of environmentally related taxes can be usefully embedded in a strategy for modernising the German tax and charge system. *The study (BERICHTE 99/3) has been published by the Erich Schmidt Verlag, Berlin, and is available from bookshops (ISBN 3-503-04863-4). A short version has been published by the same publishers under the title "Ökologische Steuerreform".* (I 2.2)

Public Administration

The study "Environmental Controlling in the Public Sector" shows that consequent environmental management by public administrations relieves the environment and at the same time can pro-

Figure 17: Environmental offences in Germany, 1999



vide savings in the order of billions of Deutschmarks. It was submitted by Difu (the German Institute of Urban Affairs) and by the ÖKOTEC Institute for applied environmental research. *The study (TEXTE 99/8) is available from the Central Reply Service (see info box page 94).*
 (I 2.2)

Environmental Audits I

The research project "Eco-Audits and Deregulation in Domestic Laws at the Legislation and Enforcement Level according to Regulations 1836/93/EEC" which was produced under the management of Prof Eberhard Bohne and Prof Hellmut Wagner, deals with possible simplifications in enforcement and in the environmental legislation requirements for business locations which participate in the EC environmental audit system.
 (I 2.1)

Environmental Audits II

To determine the actual status and perspectives of the European Eco Management and Audit Scheme, in short EMAS, the UBA carried out a survey of all German business locations registered by the end of 1998. The results confirm the ecological and economic benefit of EMAS, however, they also point out deficits, for example a low PR effectiveness. The

brochure "EG-Umweltaudit in Deutschland" is available free of charge from the Central Reply Service (page 94).
 (I 2.2)

New Logo

The European Commission has decided to introduce a new logo as part of the pending amendments to the EC Environmental Audit Ordinance, to improve the advertising benefit for the participating companies and organisations. The logo, developed by the Agenta Advertising Agency, Münster, was chosen as part of a European selection process (Figure 18). "EMAS" stands for the official name of the environmental audit system (Eco Management and Audit Scheme).
 (I 2.2)

Attitudes towards the Environment

The decline of the ranking of environmental protection in the eye of the public is the subject of intensive discussions in social-science environmental research. A more in-depth analysis on attitudes to the environment and environmental behaviour in Germany shows, however, that no general loss of significance of environmental awareness and environmental behaviour can be deduced from this in the everyday life of the population. Peter Preisendörfer: "Umwelteinstellungen und Umweltverhalten in Deutschland. Empirische Befunde und Analysen auf der Grundlage

Figure 18: New EMAS Logo



der Bevölkerungsumfragen Umweltbewusstsein in Deutschland 1991–1998” has been published by Leske + Budrich, Opladen and is available from bookshops (ISBN 3-8100-2479-1). (I 2.2)

Making Sustainable Development Popular

The concept of “sustainable development” must be made known to a broader section of the public. To this end, a specialist discussion “Strategies for the Popularisation of the Model of Sustainable Development from a Social Sciences Perspective” was held from 18th to 20th March 1999 at the Federal Environmental Agency. *The two-volume document has recently been published by the UNESCO Contact Office for Environmental Education.*

(I 2.2)

Local Agenda 21

A guide has been produced for the promotion of the Local Agenda 21 Process in Germany. *The brochure, “Lokale Agenda 21 – Literatur, Ansprechpartner, Internetadressen” is available free of charge from the Central Reply Service.*

(I 2.3)

Financial Equalisation

Based on an analysis of the spatial translocation of environmental impacts between local territorial bodies, one study discusses possibilities for dismantling these so-called external effects. It suggests problem-specific supplements in the form of assigned purposes, so as not to overload the mechanism of the municipal financial equalisation. *“Einbau ökologischer Komponenten in den kommunalen Finanzausgleich”, Financial Science Research Institute for Public Finance at the University of Cologne, will be published as part of the BERICHTE series by the Erich Schmidt Verlag, Berlin, and will be available in bookshops.*

(I 2.2)

Spanish Glossary

Based on the publication “Glossary of Spatial Environmental Planning”, which is already available in German, English and Hungarian, a translation into Spanish is also now available. *“Glosario de la Planificación Medioambiental del Territorio” is available free of charge from the Central Reply Service.*

(I 2.3)

Spatial Environmental Planning

The abridged versions of the research reports on spatial environmental planning published in German as TEXTE 55/97, have also been published in updated versions in English. They can also be obtained via the internet (<http://www.umweltdaten.de/rup/veroeffentlich>). *“Environment and Spatial Planning” (TEXTE 99/90) is available free of charge from the Central Reply Service (page 94).*

(I 2.3)

Environment and Justice: 3rd Dessau Discussions

“Environment and Justice – What does Sustainability mean for International Economic Order?” The 3rd Dessau Discussions were held on 10th September 1999 in the Bauhaus in Dessau under this motto. The podium discussion was held under the leadership of Prof Andreas Troge, President of the Federal Environmental Agency, and the participants were: Dr Katrin Grüber, Vice President of the Parliament of North Rhine Westphalia, Ralf-Dieter Brunowsky, Chief Editor of the magazine “Capital”, Holger Platz, Mayor of Dessau, Sabine Schlüter, Managing Director of the “Arbeit und Umwelt” foundation of the Trade Union Mining, Chemistry, and Energy, and Prof Scherhorn, Director of the working group “New

Models for Prosperity”, Wuppertal Institute for Climate, Environment and Energy.

Motivation-promoting measures, measures for environmental education, increased transparency and improved participation can be crucial starting points for making a contribution to sustainable development – at an international level as well. However, institutional changes which deal with the structure of international organisations and the legal and economic framework conditions under which the international economic relationships take place, are also indispensable. The internalisation of external costs is of central importance here, especially as this may result in a contribution to environmental protection as well as achieving more justice. (I 2.5)

The Efficiency of Power Stations

An improvement in the efficiency of power plants leads to fuel savings and thus to reduced waste gas emissions – from classic air pollutants such as dust, sulphur dioxide, and nitrogen oxide, through to climate-influencing emissions, in particular carbon dioxide.

Questions of the definition and determination of the efficiency have significant relevance for environmental protection. Therefore, the Federal Environmental Agency (UBA) worked on the *Guidelines of the Verein Deutscher Ingenieure (Association of German Engineers – VDI) “Determining the efficiency of conventional power plants”*. The UBA contributed the work on stipulating efficiency requirements for the limited exemption of gas power plants from the mineral oil tax. This exemption of gas power plants from the eco tax does not give them preferential treatment, but only temporarily puts them on an equal footing with natural gas and coal. (I 2.5)

Energy Parameters for Plants

For many industrial plants, energy consumption is the decisive factor for the emissions that affect the climate. The different operating methods and durability of plants make it difficult to assess the annual energy consumption of plants and makes it seem advisable to relate energy consumption to a parameter which is connected with the plant output and which enables a comparison with other plants. Such reference parameters can be the annual pro-

duction quantity, the gross added value achieved, technical performance parameters and many others.

In a research project, the Federal Environmental Agency had energy parameters collated for 15 branches. These include the branches of industry for the manufacture of sugar, beer, paper and pulp, glass, fine ceramics, clay tiles, cement, non-ferrous metals, foundry products and iron and steel products. (I 2.6)

Methane Emissions in Hard Coal Mining

Methane is the second most important climatic gas after carbon dioxide. Hard coal mining is an important source of methane emissions. 69 % of the methane produced in German hard coal mining is emitted into the atmosphere. In addition, 110 kilotonnes of methane are emitted from disused mines.

A leading study on the “Reduction of Climate Relevant Methane Emissions in Hard Coal Mining”, sponsored by the Federal Environmental Agency and carried out by the Institute for Environmental Technology and Analytics (IUTA), undertook a technical, economic and ecological assessment of the measures for increasing the controlled collection and more extensive utilisation of methane emissions from hard coal mining. The study showed that apart from the intensification of pit gas removal by suction and its energetic utilisation, a range of additional measures could provide a significant contribution to the reduction of the methane emissions, for example:

- Self-regulation of the German hard coal mining industry;
- Simplification of the approvals procedures;
- The creation of marketing instruments;
- Taxation and financial incentives.

(I 2.5, III 2.2)

Municipal Heating Performance Tables as an Instrument for achieving CO₂ Reductions

Heating performance tables serve to collect and present heating energy and heating costs data of centrally heated multiple family housing. They increase transparency with respect to heating costs

in buildings and enable identification of potential energy savings. Heating performance tables can therefore be used as an advisory instrument both for tenants as well as for lessors. For ecological and economic reasons, heating performance tables should primarily instigate as many rehabilitation measures as possible by "high-level consumers", which are the 10 percent of buildings with the highest consumption.

Within the scope of a project sponsored by the Federal Ministry for the Environment and the Federal Environmental Agency, heating performance tables were produced for seven towns. Important results of the project are:

- on average, the heating energy consumption lies around 100 % higher than today's possible standard,
- it is even 200 % higher for the high-level consumers,
- a nationwide energetic rehabilitation of the high-level consumer group would be accompanied by a reduction in the carbon dioxide emissions from centrally heated multiple family housing of 10 %.

(I 2.6)

National Data for Energy Consumption and CO₂ Emissions

To assist the international climate negotiations, the Federal Environmental Agency had energy-related analyses and meaningful indicators for energy efficiency for the Annex I-States (OECD and Eastern European countries) produced in a research project. The data collated and the comparative indicators developed are helpful for deducing baselines for designing the Clean Development Mechanism (CDM) and Joint Implementation (JI) as well as for the trade with emissions certificates.

(I 2.5)

Cooperation in Climate Technology

The Federal Environmental Agency (UBA) actively participates in the Climate Technology Initiative (CTI) of the Organisation for Economic Cooperation and Development (OECD). The CTI activities primarily aim for a transfer of technologies from the industrialised to the developing countries and the Central and Eastern European countries. This provides the opportunity of implementing the requirements of the international climate negotiations in

international cooperation. On the other hand, practical technological successes should have a positive effect on progress in the climate negotiations. Within the scope of the CTI work, the UBA heads the working group on capacity building. The focus of this work is to develop capacities and networks for an international cooperation – above all in increasing energy efficiency. Up-to-date information as well as material on climate technology can be found on the CTI website (<http://www.climatetech.net/>).

(I 2.5)

CTI "Best Practices Seminar" in Ostritz

The CTI "Capacity Building" working group held a seminar on the topic of "Best Practices in Climate Technology and Energy Efficiency in Central and Eastern Europe", from 6th to 10th December 1999 in the International Meeting Centre Marienthal in Ostritz. 66 representatives from 22 countries took part – from Kazakhstan to Belarus, from the USA to Japan. The focus of the seminar were the use of the internet as a database for climatic protection technologies, improving efficiency in energy production and in energy transport, in the area of buildings and in the consumer sector, in the industry and crafts sector, financial strategies for energy efficiency measures as well as future tasks and challenges for the energy efficiency networks. As a result of the seminar, eleven delegations volunteered to carry out further workshops in their own country on individual problems of energy efficiency. The results of the seminar will be available as a UBA publication and in the internet.

(I 2.5)

Energy and the Environment in the EU Associated Countries

The countries Estonia, Poland, the Czech Republic, Hungary, and Slovenia are preparing for entry to the European Union. The research project "Instruments and Options for Environmental Policy in the EU Associated States" investigates measures instigated by these countries. An analysis of the energy sector and its structural changes as well as the resulting CO₂ reductions was carried out for each country. Legal loopholes with respect to the EU requirements were determined and possible measures were identified. Within the scope of the project, the existing network structures were used for energy efficiency centres and developed.

(I 2.5)

Division I 3:

Transport, Noise

Traffic Information and Control Systems

Prognos AG investigated the "Environmental Effects of Traffic Information and Control Systems in Road Traffic" on behalf of the UBA. The result: Telematic systems only provide a noticeable contribution to the reduction of exhaust emissions if they lead to a reduction in vehicle mileage. In systems which only aim to achieve better flowing road traffic, the positive and negative environmental effects mainly cancel themselves out. (I 3.1)

Baltic Sea Transport

The UBA has had the framework conditions and decision-making procedures for investments by the international financial institutions and national governments in the Baltic Sea region analysed and suggestions for a process for sustainability in the transport sector developed. The second phase of the project aims to achieve international law validity of the suggested guidelines as the HELCOM Recommendation (Helsinki Commission, see page 97). *The report "Transport Sector Investment Decision Making in the Baltic Sea Region" is available free of charge from section I 3.1.* (I 3.1)

Site-Related Traffic

The ifeu – Institute for Energy and Environmental Research, Heidelberg, working on behalf of the UBA, investigated the topic "Recording of the site-related traffic within the context of a company eco-audit and approaches for environmentally sound logistic and traffic avoidance in the environmental management system". *The guide is available free of charge from section I 3.1.* (I 3.1)

Fuels

The *EC Fuel Directive (98/70/EC)* stipulates a greatly reduced benzene content in petrol from the year 2000. From 2005, the levels of sulphur (maximum 50 parts per million, ppm) in petrol and diesel and aromatics (max. 35 % by volume) in petrol have to be significantly reduced. The international automobile industry even requires a sulphur content of less than

10 ppm in petrol and diesel fuel as a prerequisite for the introduction of reduction technologies for nitrogen oxides (NO_x) for diesel-driven vehicles and for lean burn petrol engines, so the limiting emissions values of Euro IV and Euro V can be complied with. (see Chapter 9).

In Germany, "low sulphur" petrol and diesel fuels with less than 50 ppm sulphur will be indirectly subsidised fiscally from 1st November 2001, taxing fuels with a higher sulphur content by another 3 Pfennigs per litre. From 1st January 2003, the tax benefit will apply to "sulphur-free" petrol and diesel fuel with less than 10 ppm. Germany notified the EU Commission of these plans in autumn 1999 and at the same time suggested the compulsory introduction of "sulphur-free" fuels in the EU from 2007. (I 3.2)

Non-Road Mobile Machinery

The *Directive 97/68/EC for Non-Road Mobile Machinery* is to be extended to include small petrol motors and a third limit value stage for diesel engines is introduced. To further develop the *Directive 75/159/EEC* (agricultural and forestry tractors), a Joint Position of the EU Environment Ministers was passed on 22nd November 1999. It is to be expected that the Parliament will approve this directive in the year 2000. Overall, these drafts are oriented to the *Directive 97/68/EC* and the US American regulations to achieve worldwide harmonisation. (I 3.2)

The Life Cycle of Cars

The Institute for Plastics and Plastics Testing (IKP) of the University of Stuttgart completed the research project "The Emissions Balance of Cars over the Whole Life Cycle" on behalf of the UBA. In particular, it can be used to value emissions reducing measures in operations – for example lightweight construction for reducing carbon dioxide (CO₂) emissions – compared to possible additional emissions in production and disposal. (I 3.2)

Diesel Locomotives

Together with Deutsche Bahn AG, the UBA held a workshop in the autumn 1999 on "Pollutant Emissions of Large Rail Engines". The lecturers discussed the existing structure of the stock of diesel locomotives in Europe, potential pollutant reductions and the future of exhaust gas legislation. Common

ground and differences in comparison with heavy duty vehicle technology as well as starting points for air pollutant reduction technologies became clear. As a result, the UBA will make suggestions for limit values. (I 3.2)

In-Use Compliance Testing of Petrol-Driven Cars

Almost a third of 25 car models with a petrol engine tested (94 vehicles) no longer comply with the original exhaust gas values. This was the result of a UBA research project. The reasons were inter alia, design defects and incorrect maintenance instructions which may lead to damage to the exhaust gas reduction system. The owners of the vehicle models concerned were requested by the manufacturers to return their vehicles to the workshops for repair of the defects free of charge. In the future, implementation of the *EC Exhaust Gas Directive (98/69/EC)* at a European level with respect to the foreseen in-use compliance testing needs clarifying in detail. (I 3.2)

MTBE Warning Lifted

The addition of MTBE (methyl tertiary butyl ether) is intended to reduce benzene and aromatics in petrol. At the end of March 1999, the suspicion of a carcinogenic effect and the verification of MTBE in groundwater, primarily from leaks in pipelines and petrol stations, led to MTBE being banned in California from the end of 2002. In Germany, significantly lower quantities and concentrations of MTBE are used. Due to the high safety standards in Germany, leakages in pipelines and at petrol stations are significantly lower than in California. There is therefore no acute environmental risk from the use of MTBE in fuels. (I 3.2)

Emissions from Ocean Shipping

The share of sulphur dioxide (SO₂) from shipping emissions has rarely been taken into account in previous considerations of emissions sources. Along highly trafficked international water routes, it reaches a level which impairs the quality of air on coasts and in port regions: In the northern Atlantic and Pacific, it is over 60 % in July. In the remainder of the Northern oceans, ships are responsible for over 30 % of the SO₂ emissions forecast. In the city area of Hamburg, 80 % of the SO₂ emissions or around 2,300 tonnes per year stem from ocean shipping. (I 3.2)

Emissions Balance for the North Sea and Baltic Sea

In the research project MARION, the Port Authority in Bremen produced the first ever emissions balance for shipping in the German marine territory of the North Sea and Baltic Sea. In 1997, around 97,000 ships were registered in the ports with a dwell time of 902,000 hours, and in the balance region a mileage of almost 13 million sea miles. 716 kilotonnes (kt) of fuel consumption led to around 13 kt of oil-bearing residues, 44 kt sulphur dioxide (SO₂), 48 kt nitrogen oxides (NO_x) and 2,300 kt carbon dioxide (CO₂). In addition, 3.8 tonnes of zinc as well as 1.3 tonnes tributyl tin (TBT) were emitted. Furthermore, 310,448 m³ of dirty water (toilet outlets) and 513.302 m³ lightly soiled water (from kitchens and washbasins) were produced. The total quantity of waste was calculated at around 11 kt. (I 3.2)

Immissions Assessment for Noise

The working group of the EU Commission on "Immissions Assessment Parameters" in which the UBA took part, produced a position paper in which inter alia, the following suggestions are made:

For the determination of the immissions:

- Use of the average equivalent continuous sound level L_{Aeq}
- Determination of the L_{Aeq} for 12 hours during the daytime, 4 hours in the evening, 8 hours at night
- Determination of the immissions for each type of noise source (flight, road, rail, industry) separately.

For reporting to the European Commission:

- Use of the L_{EU} (European indicator for environmental noise), determined from the approximation levels of the various daytime periods while taking into consideration supplements of 5 dB for the effect in the evening and 10 dB at night
- Additional use of the L_{EUN} (European indicator for environmental noise at night), of the approximation level during night time
- Calculation of the noise immissions at a height of 4 m above ground without reflections in front of the facade exposed the most.

Particular specific characteristics of noise sources, for example tonal and pulse components, the occur-

rence of lower frequencies, are basically added to the sources as characteristics (are not supplements to the approximation level).

The suggested parameters fit relatively easily in the system used in legal regulations in Germany (see Chapter 8); at present, there are only fundamental differences still for aircraft noise. It needs to be examined how far the suggestions can be followed in Germany even in individual cases. The English version of the position paper is available under <http://www.xs4all.nl/~rigolett/ENGELS>.

(I 3.4)

- No lower noise emissions were able to be verified for timber sleeper tracks compared to concrete sleeper tracks.

The UBA will insist that these results are taken into consideration in the revision of the "Schall 03" guidelines. (I 3.4)

Noise Emissions of Machines and Equipment Operated Outdoors

The EC *Directive for Noise Emission in Machines and Equipment Operated in the Open Air* contains requirements for labelling around 60 types of machines and equipment and limiting values for around 20.

After the EU Parliament agreed to the Directive in 1998 – based on German suggestions – the Council of the European Union assumed a "Joint Position" on it on 24th January 2000. It is to be expected that the Directive will be passed in the year 2000. It must then be implemented in German law within a year.

(I 3.4)

Noise Emissions from Tramways

In the 1990's, there were numerous developments with a variety of effects on tramways both in vehicle technology (for example the introduction of the low-platform rail), as well as in the tracks (new types of structures such as elastic rail seats) as well as in the maintenance of both systems. A measurement of noise emissions carried out by the Federal Environmental Agency showed that:

- On average, low-platform tramway cars are 2 dB(A) quieter than conventional ones, which means almost only half as loud.
- The noise emissions of well maintained wheel/track systems are around 3 dB(A) lower than the average condition.
- The fixed (covered) track is around 2 dB(A) louder than given in the *Guidelines of the Deutsche Bahn for Calculation of the noise immissions of rail routes ("Schall 03")*.

Department II: Environment and Health: Water, Soil and Air Hygiene, Ecology

Division II 1:

Ecology

Biological Diversity

Both the protection and sustainable use of biodiversity, as agreed upon in the UN *Convention on Biological Diversity* (<http://www.biodiv.org>), penetrate all areas of environmental protection. German legislation has not only included individual components of biodiversity since the agreement was passed in 1992, they have been protected as the final point of substance assessment for longer. Apart from nature protection, the service potential of biodiversity has also been identified, for example in the role of microorganisms in soils for maintaining soil fertility.

The work of the Federal Environmental Agency (UBA) is focussed on systematically identifying the requirements for the explicit consideration of the diversity of the biota. The main topic will be the sustainable use of the biological diversity – or put in another way: the resources and service potential to maintain natural processes and functions.

Additional information can be found on the Internet (<http://www.umweltbundesamt.de>, "Facts and Figures"). The UBA cooperates in the Clearing House Mechanism (<http://www.biodiv-chm.de>) for the exchange of information about national contributions.

(II 1.1)

Ten Years of International Critical Loads Mapping

The UN-ECE programme for mapping critical loads and where they are exceeded has been underway since 1989 and is chaired by Germany with a common methodology (<http://umweltbundesamt.de/>

[mapping](#)). 24 European countries are participating in the project.

The successful conclusion of the protocol negotiations led to confirmation of the mandate and of the future work schedule for the mapping programme. (<http://www.oekodata.com/IPmapping>).

Further information about the programme structure and other international activities in which the UBA is involved are available on the internet (<http://www.umweltdaten.de/uid.html>). These include up-to-date acidification and eutrophication data for forest soils, data about ozone pollution as well as corrosion data for materials such as zinc, steel and copper.

(II 1.2)

Critical Loads for Heavy Metals

In October 1999, a workshop of the UN Economic Commission for Europe (UN-ECE) was held in Schwerin within the framework of the *UN-ECE Convention on Long Range Transboundary Air Pollution* (LRTAP, see Chapter 13) on the topic "Effects-Based Approaches for Heavy Metals". It formulated the scientific basis for effects-based reduction measures for future regulations. *The documentation "Workshop on Effects-Based Approaches for Heavy Metals Proceedings" (TEXTE 99/87) is available from the Central Reply Service.*

(II 1.2)

Detailed reports and background information is available on many of the topics, some of which in English as well. All orders from outside Germany may be directed to the Central Reply Service of the UBA, Bismarckplatz 1, 14193 Berlin, Germany. Fax ++49-30/89 03-2912. A list of all UBA publications is also available from here, free of charge.

Alien Organisms

The introduction of alien plant species has far reaching ecological consequences. It represents a potential threat to the diversity of the native community of flora and fauna. In Germany, the spread of alien species into the wild requires a permit in accordance with the *Federal Nature Conservation Act (BNatSchG)*. In a research project, the Institute for Ecology of the Technical University (TU) of Berlin summarises the ecological effects of alien plants on other plants and animals and analyses and assesses them. Based on this, a guideline for the application of § 20 d BNatSchG (Provisions for approvals for the release of alien species) is to be developed.

(II 1.3)

Dioxins and Furans: Protection of Livestock

Polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) as well as coplanar polychlorinated biphenyls (PCB) (PCBs, which can take up a dioxin-like structure) was also intensively discussed in 1999. This not only applies for dioxin contaminations uncovered in food and feedstuffs, but also to the reassessment of these substances by the World Health Organisation (WHO). In this context, a precautionary value of well under 1 pikogram (pg) International Toxicity Equivalents per kg body weight and day (I-TEQ/kg bw/d) are to be aimed for. The commission of the Association of German Engineers (VDI) on protecting clean air will produce a guideline on dioxins and furans for the protection of livestock at the instigation of the Federal Environmental Agency.

(II 1.3)

Dioxins and Furans: Protection of Soils

To deduce limiting and guideline values for the concentration of PCDD and PCDF in soils, precise knowledge of the background loading is required which reflects the general existing anthropogenic (caused by humans) loading of soils. To determine both the current loading situation and long-term changes in the soil quality, the UBA carried out investigations on chloro-organic substances in soils in 26 locations of the UBA air-measuring network. The sampling took place in 1989/90 in the former Western Federal States and in 1996/97 in the New Federal States (former East Germany/GDR).

The PCDD and PCDF contents of soil samples from rural regions of the New Federal States with different types of usage do not significantly differ from those from the former Western States. The maximum values for fields used for agriculture within the measuring network lie below the target value recommended by the Federal Government/States working group on dioxins of 5 pikogramm (pg) International toxicity equivalents per gram dry mass (I-TEQ/g m_r).

(II 1.6, II 1.4)

Effects on the Hormonal System

In many substances which disrupt the hormonal system a reliable degree of scientific certainty has been reached making it possible and necessary to reduce the risk to the environment by government action.

Although the risk of oestrogen effective alkylphenols is significant and well characterised by the assessing authorities of the European Union (EU), risk-reducing measures will not be introduced by the EU for some time to come.

A similar situation applies to the flame retardant polybrominated diphenylether (PBDE) which is found in alarmingly increasing concentrations in breast milk in Europe and whose concentration in the blood is also increasing in Germany (see Chapter 1). Similar to polychlorinated biphenyls (PCBs), these substances are suspected of disrupting the mental development of children by blocking the hormonal system of the thyroid glands. Since 1989, the UBA has demanded a ban on the manufacture and use of these substances.

Organic tin compounds, such as, for example, TBT (see Chapter 15) can be found in many areas of the environment and products, although they can permanently disrupt the sexual hormone system – at least in animals.

In 1999, a main aim of the UBA in this area was to provide the political decision makers and population with scientific information to achieve the fastest possible reduction in the loading of the environment.

(II 1.3)

Environmental Survey for Children and Young Persons

Children and young persons are a risk group for environmental impacts and resulting damage to health.

The action programme "Environment and Health" (see Chapter 7) pays special attention to the relationship between environmental impacts and children's health. The representative data available in Germany to date is limited to the 6 to 14 years age range and stems from 1990/92. To continue the data inventory, to record the effects on small children for the first time as well as to record health-relevant parameters in children and young persons, in 1999 the preliminary work was commenced for a pilot study for a national health and environment survey for children and young persons together with the Robert Koch Institute (RKI). (II 1.4)

Human Biomonitoring

Human biomonitoring (HBM, see Chapter 1) plays an essential role in the assessment of internal contamination of the population as well as of groups and individual persons. To assess whether and by how much contaminants found in the blood and urine lie within the range of background loading or have increased for certain persons and thus may require action to minimise contaminants and prevent damage to health, the Commission for Reference Values and Human Biomonitoring deduces values. In 1999, reference values were stipulated for a series of organochloro compounds (PCB-138, -153, -180 and their total as well as for (b-HCH, HCB) in full blood, blood plasma and breast milk as well as for total DDT in breast milk. Furthermore, in 1999 the reference values for pentachlorophenol (PCP) in serum and in urine were updated and reference and HBM-values for mercury deduced. *The detailed justifications for the values stipulated and deduced were published in 1999 in the Bundesgesundheitsblatt (issues 9/98, 5/99, 6/99, 7/99), available from the Springer Auslieferungsgesellschaft, 69041 Heidelberg, Telephone ++49-6221/3 45-247.* (II 1.4)

Medicines in the Environment

Following proper use of medicines, they can get into surface water via wastewater and the sewage treatment works when excreted by humans. Contamination of drinking water is therefore possible where surface water or groundwater affected by surface water is used for drinking water extraction.

Directly harmful effects on humans of the effect substances found in the environment are not currently

known. The concentrations in drinking water lie below the human therapeutically justified effect threshold. Therefore, the environmental hygiene aspect is at the forefront, i.e. the question of the effects of the substances found in the environment. The experiments currently underway concern precautionary measures.

Cough mixtures, cold remedies and painkillers can already be verified in surface water and in part in groundwater that is used for drinking water extraction too. To extend the acquisition of data nationally, all data concerning medicines and their metabolites found in environmental media, the substantial entry paths and drinking water are currently being collated from the Länder. (II 1.5)

Airborne Organic Substances as Groundwater Contaminants

Compared with other contaminant sources for groundwater (such as contaminated sites, agriculture), organic substances brought in via air – related to the quantities concerned – play a very minor role. Because their entry takes place over a widespread area, drinking water catchment areas cannot be protected against airborne contaminants.

Therefore, the UBA has assessed organic constituents of air with respect to their potential to reach the unsaturated soil zone of groundwater via deposition and passage.

The concentrations of the organic substances carried in this way are low – considered in absolute terms – and mostly lie below known toxicological effect thresholds. Nevertheless, they make a contribution to the many substances brought in by humans, which – each considered on its own – appear toxicologically insignificant, however, whose total and combined effects on man and the environment are virtually unknown. (II 1.6)

The Transferred Effect of Contaminants

The estimate of the transferred effect of contaminants is made using the potential of the leachate concentrations occurring in the underground. To this end, the UBA has continued to develop an assessment concept that already exists in outline. The

Agency has undertaken laboratory studies and used the data available in literature for evaluation. The concentrations of heavy metals and organic contaminants (PAH, LAS) determined from the soil saturation extracts agreed well with the values estimated by the concept with an acceptable variance for such methods.

Further improvements to this forecasting method resulted from the examination of the estimated seepage water concentrations from field lysimeter investigations and investigations of the groundwater close to the surface in shallow wells in the terrain.

(II 1.7)

Division II 2:

Environmental Hygiene

Arsenic, Cadmium, and Nickel

Based on the adopted *EC Air Quality Framework Directive* (96/62/EC), regulations including limit values concerning individual pollutants are being defined (see Chapter 13). As already carried out in the case of particulate matter, the UBA Department II 2 is responsible for the risk assessment chapter of the position paper for arsenic, cadmium, and nickel. For these elements, limit values in the air are to be developed. For cadmium, deposition limits are also under discussion. The position paper is due by the end of 2000.

(II 2.1)

WHO Centre for Air Quality

The World Health Organization (WHO) Collaborating Centre for Air Quality Management and Air Pollution Control at the UBA works in the field of ambient and indoor air hygiene in the European Region. Based on the recommendations given in the WHO strategy for the European Region "Health 21 – Health for All in the 21st Century" of September 1998, the Centre's tasks are substantially influenced by the outcome of the 3rd Interministerial Conference on Environment and Health held in London in June 1999. The 1999 work of the Centre focussed on the following subjects:

- Quality assurance and quality control in air quality management (e.g. by round-robin tests and questionnaire surveys);

- Participation in working groups and contributions to the discussion on health effects of air pollution and to political strategies in the field of indoor air;
- Intensifying the cooperation with Central and Eastern European countries.

For more information on the work and publications by the WHO Centre, please visit our web site (www.umweltbundesamt.de/index-e.htm).

(WHO-CC/Air)

Test Values for Soil Protection

In § 8 (1) of the *Federal Soil Protection Act (BBodSchG)* the Federal Government is authorised to define limit values for the protection of soil, for assessing possible harmful changes to soil or for the introduction of measures. To this end, the UBA has developed a method for the derivation of values and used this method to derive values for 13 substances. These values were incorporated in the *Federal Soil Protection and Contaminated Site Ordinance (BBodSchV)* of 18th June 1999. The derivation method was published in the *Bundesgesetzblatt*, No. 161a dated 28th August 1999 by the BMU and prescribed according to § 4 (5) BBodSchV for the evaluation of other substances.

The human toxicological and substance-specific basis of the values are published as a manual. This collection of the substance evaluations will be continuously extended: "*Gefährdungsabschätzung von Umweltschadstoffen. ...*" is published by the *Erich Schmidt Verlag, Berlin*, and is available from bookshops (ISBN 3-503-050830-3).

The rationale for the test values based on the basic toxicological data for the direct path of soil-to-man are also published. The ring binder also contains proposed test values for substances which are not named in the ordinance, and takes into consideration the volatility of the substances. "*Berechnung von Prüferten ...*" has also been published by the *Erich Schmidt Verlag, Berlin* (ISBN 3-503-05825-7).

(II 2.1, II 5.1)

Wood Preservatives in Homes

In the GDR, DDT and lindane were used as biocide agents in the wood preservative "Hylotox 59" which was applied to protect indoor wood and rafters until

1988. In the framework of a UBA research project, the contamination of indoor air and sedimented house dust in flats and attics was studied. Some of the treated attics showed high biocide contaminations. However, in general only low concentrations were found. If attics are to be upgraded to apartments, precautionary measures are to be taken. The study *“Aktuelle DDT- und Lindankonzentrationen in Wohnräumen nach intensivem Holzschutzmitteleinsatz auf Dachböden in der Vergangenheit”* (“Current concentrations of DDT and lindane in homes after intense use of wood preservatives in attics in the past”) (TEXTE 99/70) is available from the Central Reply Service (see info box on page 107).

(II 2.2, II 2.3)

Parquet Flooring and Tar-based Adhesives

Two expert meetings in 1998 resulted in recommendations on risk assessment and measures to be taken with respect to contaminations by polycyclic aromatic hydrocarbons (PAH) in homes with parquet flooring fixed with tar-based adhesives. These recommendations, combined with additional new information on the occurrence of PAH in such homes, are compiled in the booklet *“Vorkommen von polyzyklischen aromatischen Kohlenwasserstoffen (PAK) in Wohnungen mit Parkettböden”* (“Occurrence of polycyclic aromatic hydrocarbons (PAH) in homes with parquet flooring”) (WABOLU-HEFT 99/2), available from the Central Reply Service (see info box on page 107).

The health risk assessment by a UBA commission in 1999 is part of the recommendations given by the building authorities of the Länder (ARGEBAU) for the procedures to be taken in such homes. *These recommendations are scheduled for publication in 2000.*

(II 2.2, II 2.3)

Asthma and Allergies in Children

Chaired by the University of Münster, a research project on “Trends and determinants of asthma and allergic diseases of children in Germany” (in the framework of the ISAAC study) was carried out from 1995 to 1999. The UBA participated in five joint studies. The concentrations of various air pollutants were determined in homes in Dresden and Munich in order to study associations or relationships between air pollutants such as particles, nitrogen dioxide, alde-

hydes and (other) volatile organic compounds on the one hand and asthma and allergic diseases in children and young persons on the other hand.

The studies demonstrate that the concentrations of some (groups of) substances, e.g. terpenes and alkanes, are higher in the homes of children with asthma and allergies compared to the homes of other children. The available data do not yet confirm a causal relationship to the diseases under study. In comparison to Munich, in Dresden there was a trend to higher indoor concentrations of formaldehyde. This finding supports the results of former comparisons between the old and new Länder.

(II 2.3, II 6.3)

Use of Passive Samplers

There is an increasing trend to use passive samplers in the assessment of ambient and indoor air quality. This kind of device combines the advantages of simple handling, low costs, and reliability of results. They are mainly used in assessing ambient concentrations of nitrogen dioxide and benzene, but also to assess indoor concentrations of an increasing number of health-relevant organic compounds. We need guidelines providing information on the general reliability of passive samplers and advice for their adequate use. This work is performed by Working Group 11 of the Technical Committee 264 (Air Quality) of CEN that develops the consecutive parts of the guidelines series EN 13 528. Part 1 (“General requirements”) and Part 2 (“Specific requirements and test methods”) of the standard “Ambient Air – Diffusive Samplers for the determination of concentrations of gases and vapors” are currently in the process of international coordination.

(II 2.3)

Microbiological Water Investigations

Microbiological investigations of drinking water, swimming and bathing pool water as well as open-air bathing waters serve the protection of humans against pathogens. Therefore, the reliability of microbiological analyses is particularly important.

The aim of the three-year EQUATE project (1997 to 1999) was to introduce defined and durable reference materials for microbiological parameters in the daily laboratory routine and to use them to set up a quality control system which includes both continu-

ous supervision in the laboratory as well as participation in inter-laboratory tests.

The results confirm the high quality of the analyses performed by in the participating laboratories. However, problems also occurred, demonstrating the necessity of continuous controls. E.g., the nutrient medium prescribed according to the *Drinking Water Ordinance* for the verification of faecal streptococci (azide-glucose bouillon) displayed large quality variations dependent on the batch, so that in some cases even high bacteria concentrations could not be found.

The knowledge gained in the EQUASE project will be incorporated in a recommendation for analytical quality controls in water microbiology. (<http://www.phlsnorth.co.uk/equase>). (II 2.4)

Foreign Genes in Mammal Cells

Genetic engineering enables genes from various organisms to be fused with each other. Are these gene fusions only possible using genetic engineering tools or could they also take place in nature? The question got a positive answer several years ago: Ape cells which are held in a culture can take up genes directly from the E.coli bacteria. Thus, an interaction – even the fusion – of genes from two very different organisms in nature may occur.

The question, whether and how long foreign genes can be biologically active in a new environment, has been intensively pursued in recent years in the UBA. It has been found that foreign genes, although they do not have the control sequences effective for mammals' cells, are "read" by ape cells. This means that the ape cells can form proteins using the information of foreign genes. This "reading" can be observed up to three weeks following the uptake of the foreign gene. During this period, the reading activity continuously reduces until it can no longer be verified.

It can apparently be assumed that many (even higher) organisms in nature take up genes from their environment. These are not only used in the synthesis of own nucleic acids. The information, contained in the absorbed gene, also affects the absorbing cell. Occasionally, the foreign material is incorporated in the own genetic material of the host. These relationships are relevant for assessing the risks of genetic engineering (see Chapter 16). (II 2.4)

Noise Evaluation – A Campaign by the UBA and the Stiftung Warentest (Consumer Testing Institute)

Many people affected by noise are afraid of becoming ill as a result of it. In addition, they are often helpless when it comes to reducing high road traffic noise. The UBA, together with the Stiftung Warentest, started the campaign "Road Traffic Noise Evaluation": Citizens may find out whether they are subjected to noise levels that could damage health, and which possibilities – including legal measures – they have for reducing the noise. In approximately 60 percent of the cases reported, damage to health due to high noise levels could no longer be excluded. In around a fifth of the cases, noise loads were determined which, in the view of noise-effect research, could no longer be tolerated. These noise loads make it clear that there is still a need for significant action to be taken to control road traffic noise. It is also significant that three quarters of those who have commissioned a noise report, have already been making diverse attempts to reduce the noise on their road. However, only approximately 2 percent of them had any success. The Noise Evaluation Campaign will be continued.

Additional information is available from Section II 2.5 of the UBA. (II 2.5)

Noise, Stress and Cardio-Vascular Risks

Noise as a stress factor was the central topic of an international symposium in October 1998. Short-term stress is usually not harmful to health. Chronic stress and noise can lead to long-term regulatory disruptions in the organism, including the stress hormone cortisol. In healthy persons, cortisol concentrations are subject to a 24-hour rhythm, which is at a minimum during the time between midnight to approx. 4 a.m. Noise leading to a long-term increase of cortisol during this relaxation phase is harmful to health. Verification that acoustic signals – without consciously being perceived – are identified by the central nervous system and can be answered by increases in cortisol, is of significant importance for research into the effects of noise. In the case of chronic cortisol increases, the risk of health damage such as arteriosclerosis, gastro-intestinal ulcers and impairment of the immune system can arise. In long-

term studies on children, chronic increases of adrenaline and noradrenaline as well as blood pressure and reduced memory capabilities due to aircraft noise were verified. Chronic noise levels at work led to cortisol increases which were normalised within a week by wearing ear protection. The results of UBA research projects were also presented within the framework of the symposium: Long-term regulatory disruptions of cortisol were observed in a field experiment with aircraft noise for 40 nights.

Initial contributions to "Environmental Noise, Stress and Cardiovascular Risks" were published in "Noise & Health", Vol. 4 (1999), others are pending. The Längsschnittstudie ... ("Longitudinal Study on the Course of Stress Reactions under the Influence of Night-time Aircraft Noise") (WABOLU-HEFT 99/04) is available from the Central Reply Service (Info box page 107). (II 2.5)

Division II 3:

Water

Quality Status of Surface Waters

In 1999, in cooperation with the Länder (States), assessments of the data on the water quality of rivers were published. Further information is available on the Internet (<http://www.umweltbundesamt.de/wasser>). The up-to-date water situation is documented at 151 measuring points of the Länder with maps of the water quality. In addition, the development during the period 1987–1996 is illustrated using major physical and chemical parameters. The maps were produced in close cooperation between the Water Management Authorities of the Länder and the UBA. *The study Wasserbeschaffenheit ... ("Water Quality in Selected Rivers of the Federal Republic of Germany – Data Pool of Organic Environ-*

Table 17: Plant protection products (PPP) in the groundwater

Effective ingredient / Degradation product	1996			1997			1998		
	no PPP	<0,1 µg/l	>0,1 µg/l	no PPP	<0,1 µg/l	>0,1 µg/l	no PPP	<0,1 µg/l	>0,1 µg/l
Diethylatrazine	6494	1442	536	4080	792	326	2782	736	332
Atrazine	7041	1322	273	4482	725	143	3176	661	143
Simazine	7981	374	38	4909	200	29	3732	158	14
Bromacil	5355	67	137	2740	32	80	2283	36	59
Hexazinon	5738	71	76	2962	24	9	2288	17	1
Deisopropylatrazine	4871	124	25	2725	76	5	3201	77	16
Propazine	7572	93	14	4284	76	8	3327	52	6
Diuron	3981	67	25	3316	24	27	1624	18	16
Terbuthylazine	8041	74	7	4795	49	14	3551	25	9
Bentazone	3537	49	19	2382	28	13	985	10	19
Isoproturone	4461	43	12	5409	29	12	1918	18	8
Deethylterbuthylazine	5322	43	9	2765	30	2	2623	19	3
Lindane u. isomers	2524	97	11	2456	109	17	2487	150	34
2,6-Dichlorobenzamide	85	22	13	2113	85	51	258	48	53
Metolachlorine	5805	22	6	2975	14	6	2893	5	6
Sebutylazine	3470	22	4	4823	24	4	1824	9	9
Metazachlorine	7788	14	2	4488	10	10	3498	4	3
Metalaxyl	2756	8	8	545	5	3	1259	4	2
Dicegulac	303	6	10	115	2	1	103	13	4
1,2-Dichloropropane	426	4	11	303	4	5	186	5	4
Mecoprop	1818	9	5	2638	19	14	1197	10	5
Hexachlorobenzene	666	14	0	610	8	0	621	16	0
Monuron	2381	11	2	1674	2	2	471	0	1
Chlorotoluron	3470	5	6	2606	4	3	1285	4	5

µg = microgram per litre

PPP=Plant protection product

mental Chemicals 1993–1997”) (TEXTE 99/26) is available from the Central Reply Service. The *Gewässergüteatlas* (“Water Quality Atlas for the Federal Republic of Germany – Maps of the Water Quality between 1987–1996”), published by the Kulturbuchverlag, Berlin, is available from bookshops. (ISBN 3-88961-210-5) (II 3.4)

Pesticides in Groundwater

The results of the States’ monitoring of pesticides in groundwater are recorded and analysed annually. The results for the year 1998 are now available (Table 17). They clearly show that findings of diethyl atrazine, atrazine and simazine dominate in 1998 too. 63 % of all findings of pesticides concern these three substances, although atrazine is no longer allowed to be used in Germany since 1991 and simazine also has no longer had a licence since 1999.

Overall, the results are difficult to interpret, as there is no information as to whether the measuring points were identical in all the years. In addition, between 1996 and 1998 the number of measuring points investigated halved for a range of effective substances. The drinking water standard of 0.1 micrograms per litre ($\mu\text{g/l}$) for bromazil, diuron, bentazone, lindane and 2,4-dichloropropane continues to be frequently (over 1 % of the measuring points investigated) exceeded. However, statements on the spread of pesticide loads in the groundwater cannot be deduced from the data.

It is notable that 2,6-dichlorobenzamide, a degradation product of the herbicide dichlorobenil, has been the fourth most frequently occurring effective substance since 1997. In 1997 and 1998, it was found in 2.3 and 14.8 % of the measuring points respectively, with concentrations over 0.1 $\mu\text{g/l}$ in the groundwater, although to date, only two States investigate groundwater for this substance. The causes of these findings are not yet clearly explicable. Initial information implies that there is possibly a relationship between the sale of dichlorobenil in small packages and the regional accumulation of findings of the dichlorobenil degradation product 2,6-dichlorobenzamide. These findings could then be due to an increased use of dichlorobenil outside of agriculture, say on uncultivated land and in the private sector.

(II 3.5)

Bacteria as Indicators

Apart from chemical analysis, attempts are also made to use organisms for the indication of the loading of water. Within the framework of the Environmental Research Plan (UFOPLAN), the Institute for Experimental and Applied Physics of the University of Regensburg has developed a biological effects test using luminous bacteria for the continuous monitoring of surface water and wastewater streams to a stage where it is ready for use in practice. It has successfully been tested in permanent operation in two surface waters – the Rhine and Danube – as well as at the outlet of a wastewater treatment plant of a large industrial company. The luminous bacteria test has proven to be particularly suitable for wastewater monitoring.

(II 3.4)

The Microbiology of Groundwater

Contaminants affect the microbiology of groundwater. This was the result of a recently completed research project. It is planned to carry out further investigations to determine substance-specific effect thresholds for groundwater biology. The study “*Die Mikrobiologie des Grundwasserraumes ...*” (TEXTE 99/13) is available from the Central Reply Service. (See info box on page 107) (II 3.5)

The Discharge of Substances into Water

The discharge paths of the substances and the relevance of the discharges on the quality of the water are investigated based on the quality deficits in bodies of water determined.

A model of the water loading with pesticides varied out on behalf of the UBA resulted in discharges from drainage, drift and scour of approximately 15 tonnes per year. This equates to around 0.5 percent of the amount used. The model results match order of size of the loads measured in small catchment areas. In larger catchment areas, it is around 70 % and more below the actual loads. The larger, remaining part may well primarily stem from courtyard gulleys and discharges from municipal sewage treatment plants and industrial direct dischargers. The study “*Schätzung der Einträge von Pflanzenschutzmitteln ...*” (BERICHTE 2000/3)

is available from bookshops (ISBN 3-503-05865-6). (II 3.4)

Nutrients in River Basins

The programme system MONERIS (MOdelling Nutrient Emissions in River Systems) was developed to determine nutrient discharges from point and diffuse sources in the river basins of Germany. Within the framework of the Environmental Research Plan (UFOPLAN), the Institute for Water Ecology and Freshwater Fishing in the Research Association of Berlin developed a model which includes not only the runoff and quality data from the river basins investigated, but also a geographical information system (GIS). This system integrates digital maps and extensive statistical information. With the aid of this programme system, the nutrient emissions from point sources and diffuse discharge sources for a total 300 German river catchment areas were quantified for the periods 1983–1987 and 1993–1997. The nitrogen (N) and phosphorous emissions (P) were estimated for the period 1983–1987 with 1,085 kilotonnes N per year and 94 kilotonnes P per year and for the period 1993–1997 with 819 kt N/a and 37 kt P/a. The data thus show that phosphorous emissions fell in the 80's and 90's. The fall in nitrogen emissions however remained small. Further efforts

for reduction are necessary, in particular by agriculture. The study "Nährstoffbilanzierung der Flussgebiete Deutschlands" (TEXTE 99/75) is available from the Central Reply Service. (See info box on page 107). (II 3.2)

EDTA Discharges

The halving of EDTA loads in water intended by the EDTA-Declaration signed in 1991 (ethylene-diamine-tetra-acetic acid and its salts are frequently used complexing agents) has only been partially achieved. At the 13th EDTA meeting in November 1999 the Federal Environmental Agency presented, for the first time a balance for EDTA discharges in bodies of surface water to broaden the information base (see Table 18). It is intended to clearly show which discharge sources have a high potential for reduction. This is the essential prerequisite for initiating additional reduction measures, to fulfil the EDTA Declaration by the end of the year 2002.

(II 3.2)

Sustainable Water Management

The Fraunhofer Institute for Systems Engineering and Innovation Research, Karlsruhe, has devel-

Table 18: EDTA discharge balance for the year 1998

	Use in Germany in tonnes (t)	Waterborne %	Discharge in water (as EDTA acid)	% of the discharge in water
Photo industry			123 t	14
Leather industry (TEGEWA)	1 (max. 4,5)	80 - 90	approx. 1 t	0,1
Textile agents (TEGEWA)		100	53 t	6
W+R Trades (IHO)	405	100	405 t	47
of which the milk industry	146	100	146	
Body care products (IKW)	150	75	112 t	13
Household cleansing & care products	40	100	approx. 40 t	5
BASF from manufacture			15 t	2
from application			24 t	3
other chem. industry from application			43 t	6
Galvanising industry	<10		2 t **	0,2
EDTA in NTA	0,7-1,4	100	1 t	0,1
Agrochemicals	100 *	30 **	30 t **	3,5
Total			Approx. 850 t	100

* Sales in Germany

** estimated

oped a schedule of measures defining 74 focal points for action to achieve a future-oriented treatment of water. They might be incorporated in future action programmes. Action programmes have to date been implemented for all the major national (Weser) and international river basins with Germany as the bordering country (Rhine, Elbe, Oder) or are in preparation (Danube). They mainly consist of investments in wastewater treatment plant as well as measures for the maintenance and reinstatement of water structures. *The "Maßnahmeplan Nachhaltige Wasserwirtschaft" (TEXTE 99/25) is available from the Central Reply Service. (See info box on page 107)*
(II 3.2)

Water Pollution Control and Agriculture

A study produced on behalf of the UBA by the Society for Soil and Water Pollution Control, Wetzlar, shows that the provisos for the use of plant protection products are still being poorly observed. The authors recommend that many of the rather action-oriented conditions of use (for example requirements for distances) be replaced by technology-oriented conditions which would require significantly less expenditure on controls. These include measures aiming at the cleaning of spraying equipment and the disposal of leftover pesticides. The study *"Anwendungsbestimmungen zum Schutz vor schädlichen Umwelteinwirkungen" (TEXTE 99/43) is available from the Central Reply Service. (See info box on page 107)*
(II 3.4)

Substances Hazardous to Waters

Dangerous goods legislation sets specific conditions for the transport of goods hazardous to the environment. In 1999, the UBA, together with the Federal Institute for Consumer Health Protection and Veterinary Medicine (BgVV) and the Federal Agency for Materials Research and Testing (BAM), added to the list of substances that pollute water. These 315 substances are Class 9 dangerous goods in terms of road and rail transport. *A copy of the list is given in the Verkehrsblatt, Volume 23, 1999, available from the Verkehrsblatt-Verlag, Dortmund, Telephone 0180/5 34 01 41.*
(II 3.1)

Division II 4:

Drinking and Bathing Pool Water Hygiene

Drinking Water Commission of the Federal Environmental Agency (TWK)

Following the ratification of the *EC Drinking Water Directive (98/83/EC)*, in 1999 there was a need to comprehensively amend the *Drinking Water Ordinance (TrinkwV)* by means of which the EC Directive is implemented into German law. Whereas in the past the emphasis was on "drinking water as a food-stuff", the emphasis has now shifted to "water for human use". This change in paradigms does not mean a loss in quality. Instead, it much more aptly reflects the actual comprehensive importance of drinking water. Thus, it must be wholesome, clean and free of constituents that are hazardous to health. Groundwater from the natural water cycle serves as orientation for its quality.

An interruption of a water supply is always associated with hygienic and epidemiological risks in the supply area. For the assessment of the relative risks of continuation or interruption of the water supply in situations of non-compliance to values of the Directive, contingency plans for the measures to be taken need to be available. These should be developed by the water supplier in coordination with the health authority.

In-depth discussions of the working draft for the new TrinkwV was a key item on the agenda of the Drinking Water Commission (TWK) of the UBA. The results were made available to the Federal Ministry of Health (<http://www.bmggesundheits.de>).
(II 4.1)

Sustainable Drinking Water Supply

The costs of water supply are significant for ensuring household and personal hygiene. Characteristically, 80 percent of the costs are invested into the distribution network. In relation to this, the costs of extraction and treatment are low; they only have a negligible effect on the consumer price. A possible liberalisation of the water markets therefore results in little leeway for water prices. In addition, a second pipe network for lower quality water (say for rainwater without drinking water quality) is counterproductive from a hygienic point of view, because it would draw

enormous sums from the actual tasks of water supply.

A decisive aspect for sustainable management of the water supply is the small share of the demand allocated to drinking water: it only accounts for around 5 to 10 % of the total water consumption, the main consumer being agriculture.

The most important aim worldwide for a sustainable water supply is the rehabilitation of the pipe networks, as water losses of 20 to 60 % are common. In Germany, this value is currently at only 5 %.

(II 4.1)

WHO Collaboration Centre for Research on Drinking Water Hygiene

Since June 1995, the World Health Organisation Collaboration Centre for Research on Drinking Water Hygiene (WHO-CC) has been based at the Bad Elster branch office of the UBA. The plan of work includes risk assessments of microorganisms and chemical substances as well as the development of testing methods. It includes the provision of advice, training and continuous professional development for drinking water specialists, e.g. through support of training courses in the Ukraine, Armenia, Georgia, and Rumania.

The WHO-CC was involved in the preparation of the *Protocol for Water and Health* for the 1992 *Agreement for the Protection and Utilisation of Transboundary Watercourses and International Seas*, which was approved on 17th June 1999 at the Third Ministers' Conference for Environment and Health in London. (<http://www.who.dk/london99>). (II 4.1)

Microbiological Risks from New Pathogens

Chlorine resistant cryptosporidia and resistant forms of giardia have been found in raw water for drinking water treatment and in individual cases in low concentrations in drinking water in Germany. (II 4.6)

Auxiliary Disinfection Products

Apart from trihalogenmethanes in swimming pool water, bromate, chlorate and above all MX (3-chloro-(4-dichloromethyl)-5-hydroxy-2(5h)-furanon) are a focus of toxicological interest.

Although MX occurs in chlorinated drinking water only in the range of nanograms (0.8 to 60 ng/l which equates to 0.0008 to 0.06 µg/l), it has been reported that in drinking water samples in Finland, it contributes to a third of mutagenic activity (cf. Kronberg, L.; Vartianen, T. (1988), *Mutation Research* 206, 177–182). In vivo, mutagenic effects can only be verified at very much higher MX concentrations. (II 4.7)

Risks Due to Plastic and Copper Pipes

According to the Federal Environmental Agency, the assessment system for plastics must be further developed for substances which may pass from the materials into the water, for example drinking-water pipes. In addition, the studies for the assessment of the risks to infants from copper in drinking water were continued.

Apart from the existing KTW recommendations ("plastics for drinking water"), which need revision, an EAS certification system for the whole of Europe (European Approval System) is being produced which need not only comply with the requirements of the *Drinking Water Ordinance (TrinkwV)* but also those of the *EC Plastics Directive (90/128/EEC)*.

The new TrinkwV stipulates a limiting value for copper of 2 mg/l Cu as weekly average. A study carried out carefully investigates the possibility of an interaction between copper in drinking water and early signs of cirrhosis of the liver in early childhood. The data from 956 households, 20 of which constantly had over 0.8 mg/l Cu in the drinking water, are now available. In all these cases, there was absolutely no indication of liver damage. (II 4.4, II 4.5)

Metabolic Products of Cyanobacteria

In impounded dams for drinking water and in waterbodies used for recreation, toxins from cyanobacteria (or "blue-green algae") can represent a health risk. As a contribution to the guidelines of the World Health Organisation (WHO), this health risk was investigated not only for the circumstances in Germany, but also based on international experiences for a monograph coordinated by UBA. *The guidebook "Toxic Cyan bacteria in Water – a Guide to their Public Health Consequences, Monitoring and Management"*, has been published by Routledge,

London and is available from bookshops (ISBN 0-419-23930-8). (II 4.3)

Phosphate Concentration

Long-term observations of the Berlin lakes since 1981 show that there is a critical value for the concentration of total phosphorus which must not be exceeded if eutrophication is to be controlled. This threshold value for phosphate concentrations is in the range of 60 µg/l P. In specific situations, remobilisation of the phosphates from the sediment ("internal loading") can be prevented by nitrate as a oxygen carrier. Nitrate reaches Lake Tegel since 1992 instead of ammonium, as a result of nitrification in the sewage treatment works at the inlet of the lake. Subsequent to this switch in loading, phosphate concentrations in the lake have declined from 60–100 µg/L to between 25 to 30 µg/l P. The biomasses of algae and cyanobacteria have responded by further reduction. (II 4.3)

Iron and Manganese

The classical biological methods for the removal of iron and manganese from groundwater with the aid of bacteria were developed for application in small systems for domestic wells. In addition, biological process technology was also used for the treatment of problematic groundwater, formerly difficult to treat. The treatment is controlled with the operating parameters O₂ concentration (2 mg/l O₂ in the filter outlet) filter velocity (20 m/h; short-term up to 46 m/h) and redox potential (350 to 400 millivolt, mV, against silver/silver chloride, Ag/AgCl). With improved efficiency, the system can be reduced to around a third of the filter area. (II 4.3)

Independent Water Supply

There are currently two developments in domestic wells for independent water supply: In confined settlements, the supply of houses from their own wells is not justifiable due to the risk of groundwater contamination by drainage pits. An investigation of such "well villages" showed up to 73 % non-compliance for coliform bacteria and 55 % for E.coli. A connection to a central drinking water supply is urgently required in such situations.

On the other hand, the situation is totally different for scattered settlements outside of towns, where con-

nection to a central supply is only possible via a disproportionately long pipe. It is estimated that 1.5 million inhabitants live in this situation in Germany. Agreement is unanimous within Germany, including the health authorities of the Länder, that drinking water from domestic wells must satisfy the requirements of the new TrinkwV. The extent of investigations and controls, however, must be adequate to the regional situation. In addition, technical support is necessary, preferably by the local water provider. Overall, it appears feasible to rehabilitate faulty small supplies, particularly form domestic wells, within a period of nine years, allowed for in the new TrinkwV. (II 4.2, II 4.3, II 4.6)

Utilisation of Rainwater in Buildings

A reassessment of the opportunities and risks of rainwater utilisation in buildings requires caution. In towns, due to the unfavourable ratio of roof areas to inhabitants, a maximum of 2.5 % saving in household drinking water can be achieved with rainwater. On the other hand, the saving potential of modern fittings, in particular for toilet flushing, together with those of dishwashers, washing machines and tumble dryers, is in the order of 30 percent of earlier consumption values. A modern household requires – without cutbacks in hygiene – only 100 litres per day per inhabitant, which equates to an annual consumption of 35 m³ per inhabitant per year. In a worldwide comparison, Germany holds a top position for frugal use of drinking water. (II 4.1)

Division II 5:

Soils

Internet Service for Soils Protection

*The Federal Soil Protection Act (BBodSchG) came into force in March 1999. To meet the information needs of the public, the Federal Environmental Agency has greatly extended its internet service for soil protection matters (<http://www.umweltbundesamt.de/boden.htm>). Apart from the texts of the Act and the *Federal Soils Protection Ordinance* (BBodSchV), information is available on up-to-date soil protection problems, activities of the agency and suggested solutions (German only). (II 5.2)*

Soil Conservation Systems in Agriculture

Soils used for agriculture in the Federal Republic of Germany are primarily at risk from the concentration of soil damage, water and wind erosion.

Scientific results clearly show that this damage has increased significantly regionally and should not be underestimated: Under the current climatic conditions, no noteworthy regeneration of the soil damage and no measurable replacement of the soils losses are to be expected on arable land. The situation is aggravated by the fact that concentrations of damage increase the risk of erosion by water.

In the research project "Standards of soil conservation land use systems – development of assessment criteria and decision help parameters (indication of water erosion)" which was carried out by the Centre for Agricultural Landscape and Land Utilisation Research (ZALF), Müncheberg, a concept for protection against water erosion has been presented based on an indicator system developed in 1997.

The result of the practical implementation in the reference area of Kittendorfer Peene (Mecklenburg West Pomerania) was a high level of acceptance from the farmers there for the need precautionary soil protection.

The actual water erosion risk was able to be reduced to a minimum with the aid of extensive advice (prescribed by § 17 BBodSchG) using the indicator system, without the farmers experiencing any notable economic losses or any great amount of additional money being required. Economy and ecology can therefore be successfully unified to location-adjusted agricultural use of soil.

The project results were published as TEXTE 43/00 as well as a CD ROM. They are available from the Central Reply Service. (See info box on page 107)
(II 5.2)

The Rehabilitation of Contaminated Sites and Land Recycling

Within the research project "Requirements for the Rehabilitation of Contaminated Sites within the Framework of Land Recycling", a comprehensive catalogue of questions was used to assess numer-

ous project examples, so that the dependencies, interactions, recommendations for action and deficits in land recycling could be determined and illustrated. The recommendations for action and checklists can be considered as being a tool for project execution and as ideas during project initialisation as well as the set up of a suitable project structure in land recycling and in addition allow a detailed project and weak point analysis.

The final report can be read under <http://www.umweltdaten.de/altlast/web1/start.htm> and is to be published as part of the TEXTE series.

Brownfield redevelopment is also a focal topic in the European of the "CLARINET" project (Concerted Action on Contaminated Land Rehabilitation Network for Environmental Technologies). In the Working Group 1 "Brownfield Redevelopment", the already mentioned checklist is to be subjected to an international validation.

The international workshop on "Recycling Derelict Land" held in October 1999 by the Federal Ministry for the Environment and the UBA in Duisburg clearly showed that problems such as risk management, financing, efficient project management and sustainable land management are very similar in the participating countries. The financially limited possibilities of the public budgets require increased creativity of the private industry players which should be appropriately supported by political, legal, administrative and specialist framework conditions.
(II 5.3)

Contaminated Military Sites

Investigations were carried out for the specific conditions of properties formerly used for military purposes to discover how far alternative rehabilitation approaches are possible under consideration of the mostly completed data acquisition and assessment of hazardous military sites. This refers to the known contamination profile and specific areas of use and includes the typical subsequent usage conditions.

In a further project, a suitable work programme is to be developed for a fictive property formerly used by the military which defines the specific locational possibilities and limits of the utilisation of the self-cleaning potential in contaminated soils and groundwater.

The two-volume study "Entscheidungsgrundlagen für Sicherungs- und Sanierungskonzepte ..." (TEXTE 99/28 and 99/29) is available from the Central Reply Service. (See info box on page 107)

(II 5.3)

Contaminated Site Information

With the realisation of a dedicated contaminated site information service (<http://www.umweltdaten.de/alblast/web1/start.htm>), a platform exists which makes up-to-date research results available online. There is also an overview of the software available in German-speaking areas which was produced on the occasion of the workshop "Up-to-date data-processing assisted applications and the utilisation of new media for contaminated sites" in January 1999.

(II 5.3)

European Soils Forum

The first soils forum took place from 24th to 26th November 1999 in Berlin at the invitation of the Federal Ministry for the Environment and of the Federal Environmental Agency together with the EU Commission, General Directorate for the Environment. The aim of the soil forum was to discuss central questions of soils protection policy in Europe and to name specialist focal points with respect to the integration of soils protection in other political areas.

The participants agreed that soils play an essential role in the ecosystem, and that soils represent a limited, increasingly threatened and non-renewable resource. Soils are a basic prerequisite for the maintenance of human existence and the development of social activities and therefore must be protected for future generations.

The soils forum emphasised the need for international, national, regional and local activities, to meet the political, social and economic requirements of soil protection in case of a transboundary risk to soils. They suggested the following activities at a European level:

- Creation of consciousness
- Exchange of experience with respect to the various political approaches and concepts and solutions for the removal of problems
- Investigating soil protection standards in the waste industry and improved observance of the

precautionary concept for maintaining the soil functions

- Inclusion of soil protection in the 6th Framework Programme for research and in the Twinning Programme (see Chapter 5) for the assistance of acceding countries
- Integration of soil protection requirements in other fields of politics (for example, agriculture, industry, zonal planning, forestry, nature conservation, mining, construction, the free movement of goods).

The 2nd soils forum will take place in 2001 at the invitation of the Italian Ministry of the Environment.

(II 5.4)

Division II 6:

Air

Ozone Concentration

The aim of the research project "Action Programme and Schedule of Measures for Combating Increased Ozone Concentrations in Germany" was to create the principles for decision-making for a national approach to the control of high ozone concentrations. The results are documented on the Internet (<http://www.umweltbundesamt.de/ozon>).

A limited number of reports are also available on CD-ROM from Section II 6.1, free of charge. (II 6.1)

Transboundary Air Pollution

The Economic Commission of the United Nations for Europe (UN-ECE) has continued to develop the Europe-wide standards against long-range transboundary air pollution (*Geneva Clean Air Convention*). In addition, protocols were signed in 1998 on persistent organic compounds (POP) and heavy metals as well in 1999 on the reduction of acidification, eutrophication and surface ozone (<http://www.umweltbundesamt.de/ece/luftreinhalteabkommen>).

The protocols are included in the volume "UN ECE long-range transboundary air pollution" which is to be published as part of the TEXTE series. It will be available from the Central Reply Service. (See info box on page 107) (II 6.1)

Optimisation of Air Routes

Aircraft discharge gases and particles at altitudes of around 8 to 14 km directly into the upper troposphere and lower stratosphere. They therefore disrupt the state of equilibrium in the upper atmosphere. The consequences: The atmospheric concentration of carbon dioxide (CO₂) is increasing, ozone and condensation strips are formed. In addition, there is an increased formation of cirri, i.e. high, thin clouds consisting of ice crystals.

In a research project, the Federal Environmental Agency investigated how the climatic effect of emissions from air traffic can be reduced. As a result, environmentally optimised air routes were developed.

A database was formed from the results of a large number of simulations which can be used routinely for planning air routes.

The final report is available from Section II 6.1 of the UBA, free of charge. (II 6.1)

Workshop on "Air Chemistry"

The German-American "Air Chemistry" workshop held in 1999 in Riverside (California) dealt with the creation of ozone and of fine dust particles in the polluted atmosphere with the aid of "reaction chamber". The final report is available on the Internet (<http://cert.ucr.edu/~carter/epachem/meeting1.htm>).

(II 6.1)

Anthropogenic Climate Changes

Of all the potential factors influencing the climate, the greenhouse gases produced by humans have had the greatest effect. This was the result of a research project carried out by the Institute for Meteorology and Geophysics of the University of Frankfurt/Main on behalf of the UBA (<http://www.rz.uni-frankfurt.de/IMGF/meteor/klima>).

The anthropogenic greenhouse signal is, on a global scale, by far the most significant and there is – with over 99 % probability – a significant anthropogenic climate change.

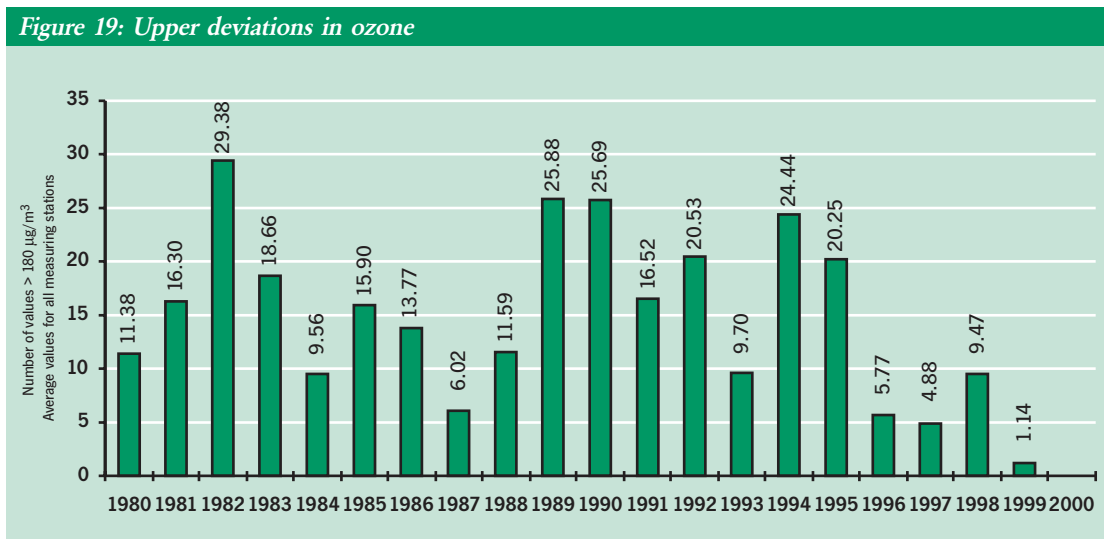
The anthropogenic signal is made especially clear by the global average temperature. This explains almost 80 % of the total variance (60 % anthropogenic greenhouse gases, 20 % remaining factors).

The report "Statistical Analyses for the Early Recognition of Global and Regional Climate Changes" is available, free of charge, from Section II 6.2 of the UBA. (II 6.2)

Air Pollutants in Cities

A pilot measuring programme for benzene, soot and NO₂ took place in Frankfurt/Main. The measurements were taken at measuring points influenced by heavy motorised vehicle traffic. Intermediate result: At all stations, the 95-percentile for nitrogen dioxide (NO₂) was less than 160 micro-

Figure 19: Upper deviations in ozone



grams/cubic metre ($\mu\text{g}/\text{m}^3$), the average value for benzene was mostly less than $10 \mu\text{g}/\text{m}^3$ and for soot $8 \mu\text{g}/\text{m}^3$. The results of this measurement programme indicate that it is to be expected that in general the listed limiting values of the European Union can be complied with in Germany.

(II 6.3)

Trading in Emissions Certificates

In the past, the emission of contaminants (in addition to the air quality data) has been used nationally and internationally for controlling the success of measures. More recent international conventions, such as the *Framework Convention for Climate Change* and their subsequent protocols, provide the possibility of trading in emissions certificates. As a prerequisite for this, the requirements of reporting duties have increased significantly. Not only do the emissions have to be recorded in much more detail but also, two new aspects have been added: The origin of the emissions data must be documented without gaps and any uncertainties of estimates have to be quantified. The Federal Environmental Agency was an active participant of the UN working groups dealing with the development of these methods. Immissions data is available on the Internet. (www.umweltbundesamt.de/immissionsdaten).

(II 6.4)

Ozone Situation in Summer 1999

In 1999, the Länder operated 346 measuring points for monitoring ozone concentrations. In addition, the Federal Environmental Agency has 22 measuring stations for the investigation of background air pollution.

The information value of $180 \mu\text{g}/\text{m}^3$ as a one-hour average was exceeded during 1999 in the months May, June, July, August and September at a total 106 measuring points over a period of 419 hours, distributed over 25 days.

Figure 19 (page 121) shows the number of hours for which the value of $180 \mu\text{g}/\text{m}^3$ has been exceeded, shown as an average over the respective operated measuring points, for the period 1980 to 1999.

The threshold value of $240 \mu\text{g}/\text{m}^3$ was not reached or exceeded at any measuring station in Germany during summer 1999. The conditions for imposing

traffic bans according to § 40a Para.1 *Ozone Act* were not fulfilled on any day in 1999. In the whole territory of Germany, no exceedance of the threshold value $360 \mu\text{g}/\text{m}^3$ for triggering the warning system in accordance with the *EC Ozone Directive (92/72/EC)* were measured.

From May to September, there were several continuous periods with high summer temperatures and intensive sunshine. Nevertheless, the ozone concentrations remained relatively low compared to previous years. The reason for this was the frequent number of air masses from the East to North East, usually least pre-loaded with ozone precursor substances. On the other hand, the additional loading of air resulting from German emissions – nitrous oxide and volatile organic compounds – has been steadily reduced in recent years.

The ozone forecasts of the Federal Environmental Agency (during the summer) as well as further information on immission loads due to ozone are available on the Internet (<http://www.umweltbundesamt.de/uba-info-daten/daten/aod.htm>). (II 6.4)

Air Quality in the Black Triangle

At the end of the 80's, the Black Triangle between the Czech Republic, Poland and Germany was the region with the highest air pollutant loading in Europe. Major emitters which were equipped with inadequate emission reduction technology were concentrated within this region. This situation was permanently improved within the framework of the PHARE environmental protection programme "Black Triangle". The astonishing improvements in air quality are documented in a joint report of the participating countries; the Czech Republic, Poland and Germany. *The report "Common Report on Air Quality in the Black Triangle Region 1998" is available free of charge from the Central Reply Service (see info box on page 107).* (II 6.4)

European Topic Centre on Air Emissions

The European Topic Centre (ETC) set up in 1994 at the Federal Environmental Agency works under contract with the European Environment Agency (EEA). Division II 6.4 manages the business of a consortium of seven international institutes and organisations. The main task of the ETC consists in assisting

the Agency in the compilation and improvement of international inventories for air pollutants. Additional information on the ETC and the EEA as well as their EIONET network are available via the web site of the ETC (<http://etc-ae.eionet.eu.int/etc-ae/index.htm>).

ETC Topic Report No. 12/1999 "European Emissions of Atmospheric Pollutants, 1980 -1996" as well as the annual report "Annual Topic Update 1999" are available free of charge from Section II 6.4. (II 6.4)

Measuring Results of the UBA

The measuring network of the Federal Environmental Agency regularly presents its results in the internet (<http://www.umweltbundesamt.de/uba-info-daten/mbm.htm>). In addition, detailed annual analyses are published. *The "Annual Report 1998 from the Measurements Network of the Federal Environmental Agency" (in German) (TEXTE 99/66) is available free of charge from the Central Reply Service (see info box on page 107). (II 6.5)*

Department III: Environmentally Compatible Technologies – Procedures and Products

Division III 1:

Technology and Product Evaluation

Biotechnology

Biotechnology has considerable potential for preventive, production-integrated environmental protection. This became clear at a working discussion which took place on 22nd and 23rd February 1999 in Berlin. 36 representatives from research, industry and authorities discussed the "Status of possibilities for process-integrated biotechnological preventive technologies to avoid or reduce environmental impacts". The use of living cells and of isolated enzymes offers possibilities to modify inorganic and organic substances by "gentle" means and to avoid energy-intensive and emissions rich steps of chemical-technical processes.

Nevertheless, it became clear that the contribution of biotechnology to relieve the environment can only be evaluated for individual cases, because: biotechnology is not per se more environmentally friendly than chemical process technology. The following conclusions can be drawn from this:

- Biotechnological processes are – just as other technologies – to be evaluated under environmental protection aspects.
- Substance and energy flow analyses or a risk assessment of the starting materials, intermedi-

Detailed reports and background information is available on many of the topics, some of which in English as well. All orders from outside Germany may be directed to the Central Reply Service of the UBA, Bismarckplatz 1, 14193 Berlin, Germany. Fax ++49-30/89 03-2912. A list of all UBA publications is also available from here, free of charge.

ate and final products will have to be used if the data situation is insufficient for a life cycle assessment.

- Processes have to be ecologically evaluated while they are still in the process of development or testing, to set the course for the development of environmentally friendly processes as early as possible.
- Conventional processes in use are to be investigated with respect to their environmental impacts and the extent of measures which are to be applied for compliance with the prescribed regulatory law standards. If necessary, proposals for biotechnological solutions must be submitted.

Close cooperation between the players from research, industry and politics is necessary both nationally and internationally. This is to be aimed for to use existing specialist competences and financial resources effectively. (III 1.1)

OECD Working Group on Biotechnology

In July 1998, the Organisation for Economic Cooperation and Development (OECD) published a report: "Biotechnology for clean industrial products and processes – towards industrial sustainability". It provides an overview how more environmentally compatible industrial production can be achieved with the aid of biotechnological methods. The report led to the setting up of the "Task Force on Biotechnology for Sustainable Industrial Development" at the OECD which inter alia has set itself the following aims:

- To elaborate instruments to determine the environmental compatibility of biotechnological processes and products
- To formulate recommendations for governmental measures to improve the environmental compatibility of products and procedures with the help of biotechnology.

The Federal Environmental Agency is involved in this work. (III 1.1)

Investments with a Demonstrative Character

The UBA provides specialist advice and management of the investment programme on behalf of the Federal Ministry for the Environment. The Deutsche Ausgleichsbank (DtA) looks after the administrative and financial side of the projects.

Grants are provided under the following prerequisites:

- The plant is being adjusted to an advanced state of the art for the reduction of environmental impacts for the first time.
- The projects involve advanced procedures and their combinations for the prevention and reduction of environmental impacts.
- At the same time, environmentally compatible products or environmentally friendly substitution materials are produced or used.

Table 19 gives an overview of all investment projects approved during the report year. To improve access to information for the applicants and interested parties and to make the progression of the project following approval of the application easier, a special dedicated coordination and contact office has been set up. *The Project Management Invest (PMI) in the Federal Environmental Agency can be contacted under the telephone numbers ++49-30/8903-3067 (Karin Fischer) and 8903-3335 (Carola Diowitz). Fax: 030/8903-3011.* (III 1.1)

Lignite Coal Rehabilitation

A German-Czech workshop on lignite coal rehabilitation took place on 23rd and 24th September 1998 in Zittau. The workshop was organised by the Association for the Promotion of International Transfer of Environmental Technology (ITUT), Leipzig, and sponsored by the Federal Ministry for the Environment and the UBA.

The rehabilitation of lignite coal mining in the former GDR is today one of the largest environmental projects in the world. However, lignite coal mining did not only lead to the creation of enormous areas of devastation in parts of East Germany, but also in the neighbouring areas of the Czech Republic. Extensive rehabilitation and recultivation works lie ahead here too.

Table 19: Overview of all investment projects approved in 1999 (listed according to approval date)

Topic	Grant recipient
<i>Procurement and operation of 56 low-emission LNG buses</i>	<i>üstra Hannoversche Verkehrsbetriebe AG in Lower Saxony</i>
<i>Introduction, testing and demonstration of a manufacturing process for thermal insulation panels</i>	<i>Hebel Dämmsysteme in Bavaria</i>
<i>Manufacture of hydrotalcite</i>	<i>Süd-Chemie in Bavaria</i>
<i>Manufacture of a new double-sided cap for tungsten-halogen lamps</i>	<i>Radium Lampenwerk GmbH in North Rhine Westphalia</i>
<i>Therbane plant with integrated rhodium recycling and continuous measurement during the hydrogenation process</i>	<i>Bayer AG in North Rhine Westphalia</i>
<i>Treatment of lower and average waste paper qualities as a cellulose replacement for the production of printing, newspaper and graphic papers</i>	<i>WEPA Papierfabrik P Kregel GmbH & Co KG, North Rhine Westphalia</i>
<i>Markranstadt Sewage and combined wastewater treatment works - microfiltration</i>	<i>Kommunale Wasserwerke Leipzig GmbH, Saxony</i>
<i>Coater recycling in the paper industry</i>	<i>Stora Kabel GmbH, North Rhine Westphalia</i>
<i>Ecological residential development Flintenbreite/Lübeck</i>	<i>Infranova Bauentwicklungs GmbH, Schleswig-Holstein</i>
<i>Biomass combined heating and power station, Pfaffenhofen</i>	<i>Biomassen Heizkraftwerk Pfaffenhofen GmbH, Bavaria</i>
<i>Plastics recycling as a raw materials base</i>	<i>Grundig Fernseh-Video Produkte und Systeme GmbH - Eco technology, Bavaria</i>
<i>Biogas in vehicles in the Hanover area, Concept competition of the BMU, DtA, UBA, KTBL</i>	<i>Wüsthof Scharringhausen Dienstleistungs GmbH, Lower Saxony</i>
<i>Truck cleaning using ozone technology</i>	<i>CG Nordfleisch AG, Prignitzer Fleischzentrum GmbH, Brandenburg</i>
<i>Enamelling furnace for catalysts</i>	<i>Katec GmbH & Co, Vertriebs KG, Hesse</i>
<i>Innovative wastewater treatment plant for the semiconductor industry</i>	<i>Hager & Elsasser GmbH, Stuttgart, Ruwel-Werke GmbH, Gerdern, Baden-Württemberg</i>
<i>Printing machine in computer-to-plate process</i>	<i>Citydruck GmbH, Heidelberg, Baden-Württemberg</i>
<i>Setting up a press works for the manufacture of WMU steel sandwich</i>	<i>Weser Metall Umformtechnik, Lower Saxony</i>
<i>Demonstration plant for the treatment of light shredder fractions</i>	<i>KAMET Recycling GmbH, renamed as R+Recycling GmbH, Baden-Württemberg</i>
<i>Conversion of the heating station, Schmidtmanstraße</i>	<i>Fernwärmeversorgungsgesellschaft Ascherleben mbH, Saxony-Anhalt</i>

The conference documentation is available free of charge from the Federal Environmental Agency, Section III 1.1. (III 1.1)

Hazardous Incidents

The operators of around 7,800 plants in Germany which are subject to the *Hazardous Incident Ordinance*, reported 15 hazardous incidents and 22 safety-relevant incidents in 1998. There were two fatalities, and 168 people have been injured. The incidents recorded by the Central Registration Office for Hazardous Incidents (ZEMA) were above all reported for chemical plants. Around 38 % occurred during normal operation. They were mostly caused by operator errors and repair and safety organisation errors. The most frequent consequence was the release of hazardous substances; only in rare cases fires or explosions occurred. Figure 20 shows the development since 1991. The low number of incidents before 1993 can be explained by the failing of operators to consequently report incidents when compulsory reporting started. *The ZEMA Annual Report 1998 is available free of charge from the Central Reply Service. (See info box on page 124).* (III 1.2)

Hazardous Incidents in Industrial Operations

An international seminar on the Prevention and Limitation of Hazardous Incidents in Industrial Opera-

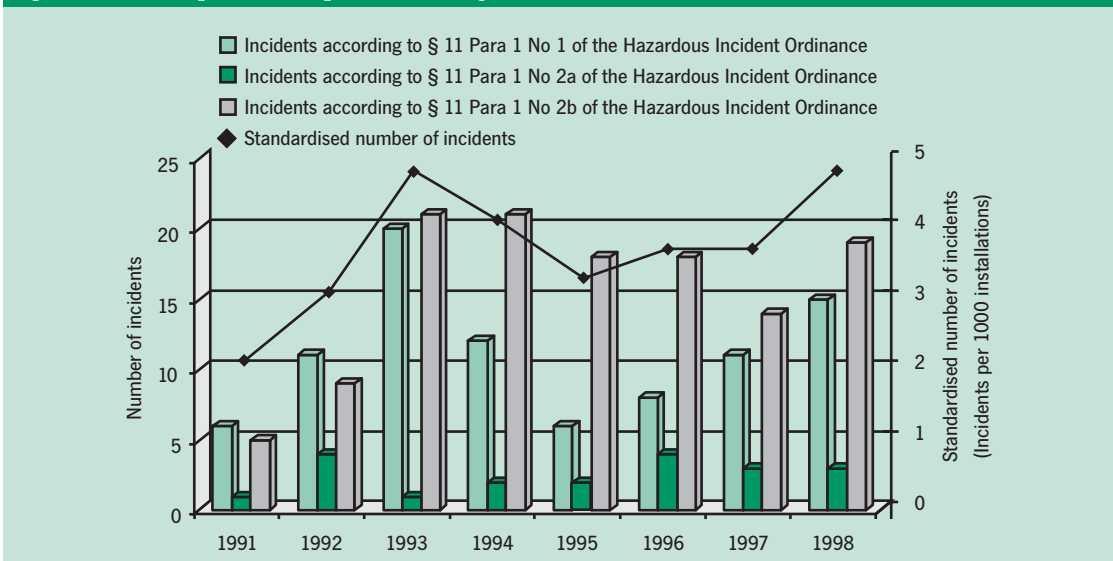
tions with Effects on Transboundary Waters was organised by the Federal Ministry for the Environment and the UBA in Hamburg from 4th to 6th October 1999. With this conference, Germany promoted implementation of the *UN-ECE Agreement on Transboundary Effects of Industrial Accidents* and the *UN-ECE Agreement for the Protection and Utilisation of Transboundary Water Courses and International Seas*. As a result, the participants recommended a series of safety requirements for the prevention of water pollution caused by chemical accidents. These were based on the proven recommendations for the plant-related water protection on the Rhine and Elbe. A work programme and recommendations will be submitted to the Second Contracting State Conference of the Water Convention in March 2000 in The Hague as well as the First Contracting State Conference of the Industrial Accidents Convention from 22nd to 24th November 2000 in Brussels. Additional information on the results: <http://www.unece.org>.

(III 1.2)

Alarm and Hazard Averting Planning on the Oder

A German-Polish workshop on the Transboundary Affects of Industrial Accidents and Alarm and Hazard Averting Planning was held by the Federal Ministry for the Environment and the UBA in Frankfurt/Oder together with the Polish authorities from 28th to 30th September 1999. In connection with this, there was

Figure 20: Development of reports according to the Hazardous Incident Ordinance



a practical alarm exercise in Slubice (Poland) for the controlling of an oil accident by placing oil barriers on the Oder. The aim of the workshop was the exchange of information and experience between the German and Polish hazard averting and environmental protection authorities. An important result was the development of an off-site emergency plan for whole of the common border. A study on this will be produced by the Polish bodies. (III 1.2)

Risk Communications

From 16th to 17th December 1999, a meeting was held between French and German experts on questions of risk communication. The reason was current implementation of the relevant requirements of the *Seveso II Directive* on informing the population of risks in the neighbourhood of dangerous establishments.

Effective risk communication is a key factor for successful and sustainable major accident precautions in hazardous establishments. It not only concerns the communications processes between those responsible and the public, but also the internal operational communication. Apart from comprehensive information for the public, the new *Seveso II Directive* places particular importance in the arrangements for the management aspects, to increase safety. Risk communication is an integral component of management systems. It requires specific experience and precise planning. Its aims:

- Changing attitudes,
- Improving levels of safety and
- Minimising evaluation differences.

The topic will be pursued further at a European level. Apart from the exchange of experiences between all European states, the aim is to develop uniform recommendations ("best practice") for risk communications. (III 1.2)

Environmentally Friendly Procurement

Public procurement is becoming increasingly important within the framework of product-related environmental policy. To provide the decision makers in administration, municipalities and companies with an orientation aid, the UBA has published a new manual. The study "*Umweltfreundliche Beschaffung*" has been published by the *Franz Vahlen Verlag, Munich*

and is available from bookshops (ISBN 3-8006-2437-0). (III 1.3)

An Guide to "Ecobalances" (LCA)

The UBA has published a guide to "Ecobalances" (Life Cycle Assessments). It contains a summary of the knowledge available on working mechanisms, environmental quality targets and the current state of the environment. "*Bewertung in Ökobilanzen*" (TEXTE 99/92) is available from the Central Reply Service. (See info box on page 124)

Ecological Product Design

In October 1999, following long preparations, the Technical Committee for "Environmental Management" of the International Organization for Standardization (ISO/TC 207) started work on the new standard "Guidelines to integrating environmental aspects into product development" (Working title: "Design for the Environment", DFE). The intention is to produce a process standard for ecological product design which offers both an orientation and communications framework for all product developers, worldwide. It is planned to name the environmental objectives of ecological design and to deal with the organisational linking of design with environmental management systems in companies. (III 1.3)

Environmental Labelling

The European eco-label award scheme has existed since 1992 and is currently available for 15 product groups. To date, only a few companies in Europe have made use of this label. In Germany, not a single company has applied for the flower-shaped environmental label. The background of this scepticism was the subject of a study carried out in 1999: In principle, the introduction of a Europe-wide environmental label is welcomed by 90 % of those asked. However, the current form meets with little approval. Above all, the costs are considered to high. Those questioned primarily see advantages in the European eco-label label with respect to harmonisation of ecological standards within the common market. In their opinion, there are potential improvements in increasing the visibility of the label in the market and in tightening up the award procedure. This is currently being dealt with by the ongoing revision of the *EC Regulation on a Community Eco-label Award Scheme*.

On the other hand, the German environmental label, the "Blauer Engel" (Blue Angel), continues to enjoy a high level of acceptance. Thus, in 1999 over 400 new products were awarded the environmental label. Around 800 providers from home and abroad currently use the "Blue Angel" for over 3,800 environmentally friendly goods and services. During 1999, seven new environmental label award principles were added (Table 20), including the 100th environmental label for car sharing transport services (Figure 21).

Further information on the new environmental label, the applicants of the label and the products bearing the environmental label is available on the "Blue Angel" homepage (<http://www.blauer-engel.de>). Information is available in English as well. (III 1.3)

Volatile Organic Substances

Emissions from volatile organic substances (VOC) can form photo oxidants when reacting with nitroxides with simultaneous intensive sunlight. These substances – also called summer smog – are harmful to health and the environment. To avoid permanent harmful effects on humans, the VOC emissions must be reduced by 70 to 80 % with respect to the 1998 values.

50 % of VOC emissions in Germany stem from the use of solvents, for example in painting works, gluing, cleansing activities and in printing. The emissions-limiting requirements of the *Technical Instructions on Air Quality (TA Luft)* have already applied to large plants for years.

The *EC Solvents Directive* which was passed on 11th March 1999 and has to be implemented in national law within two years, also stipulates emissions-limiting requirements.

Table 20: New environmental labels in 1999

Basis of award	ID Number
Domestic washing machines	RAL-UZ 96
Domestic dishwashers	RAL-UZ 97
Domestic tumble dryers	RAL-UZ 98
Movement area de-icers for airports	RAL-UZ 99
Car Sharing	RAL-UZ 100
Gas and electric ovens	RAL-UZ 101
Low-emission wall paints	RAL-UZ 102

Figure 21: The 100th environmental label



There are no technologies for waste air cleaning for the other, smaller plant and in particular for open craftsman applications or for private consumers, or if there are, they are disproportionately expensive. To reduce VOC emissions here too, an instrument is required, which places emphasis on product-related measures. In many areas, low emission materials such as water-based paints, powdered paints, aqueous cleaning agents, dispersion and melted adhesives as well as low-emission print colours are available. Such products have to date been used much less than is possible – even under economic aspects.

Product-related measures for the implementation of the *EC Solvent Directive* are permissible in spite of the strict competition laws of the EU, if they are no less economic for the respective plant operator than equivalent plant related measures. *The study "Produktbezogene Maßnahmen ..."* (TEXTE 2000/9) is available free of charge from the Central Reply Service. (See info box on page 124) (III 1.4)

Building Materials

In 1999, implementation of the *EC Building Materials Directive*, which was implemented in German law by the *Building Materials Act 1992*, played an important role.

The existing regulations in Germany were incorporated in the draft of the guidance paper "Hazardous

Substances" of the EU Commission for further development of the essential requirement of "Health, Hygiene and Environmental Protection". In the opinion of the UBA and of the German Institute for Construction Technology (IfBt), further reaching steps should be taken when producing technical specifications for construction products (standards and technical approvals) by limiting or banning substances which are known to have harmful effects, but have not yet been dealt with in statutory regulations. These include solvents and other volatile organic compounds (VOC) in indoor air or in the domestic environment.

Further environmental aspects of building materials, such as energy and resources consumption, can be considered with the aid of life-cycle assessments. A handbook is currently being produced by a working group of SETAC (Society of Environmental Toxicology and Chemistry) with the participation of the Federal Environmental Agency. (III 1.4)

Refrigerant R 22 Banned

Chlorodifluoromethane (R 22) is one of the partially halogenated hydrochlorofluorocarbons (H-CFC) which contribute substantially to the damage of the ozone layer. It is primarily used in trade and industry as a refrigerant.

Since 1st January 2000, it has been forbidden to distribute or use this refrigerant in Germany. This also applies to mixtures that contain R 22. Equipment and plant that contain R 22 may also no longer be produced or distributed.

R 22 can continue to be used in installations and equipment which was produced or distributed before the closing date and can also be refilled. This transition rule applies until the equipment or plant is decommissioned or until alternative refrigerants with low ozone degradation potential can be used as state of the art. As yet, there is insufficient experience available for converting existing refrigeration units with R 22. (III 1.4)

Substitute Refrigerant for R 502

After R12, R 502 is the most important ozone layer degrading refrigerant. It contains over 50 % of the fully halogenated R 115 and the partially halogenated R 22 banned in the *CFC Ordinance* of 1991. The re-

frigerant R 502 contributes to around 9 % of the annual emissions of fully halogenated CFCs from the cooling technology sector – related to the ozone-degrading effect. After testing potential replacement refrigerants, the UBA published the following replacement refrigerant mixtures:

- R 404 A (R 125/R 134a/R 143a)
- R 407 A and B (R 32/R 125/R 134a)
- R 507 (R 125/R 143a)
- R 32/R 125/R 143a (Mix ratios: 10 %/45 %/45 %).

These refrigerants have been investigated with respect to their toxicological properties. The use of other agents than those named which have a much lower ozone degradation potential than R 502 is permissible. In future, the use of replacement substances without an ozone degrading potential should also be standard in old installations.

With the publication of the substitute refrigerants, the transition ruling for products containing R 502 contained in § 10 Para. 2 of the *CFC/Halon Prohibition Ordinance* becomes invalid. As the banned usage refers to direct handling of R 502, it is *inter alia* forbidden to refill R 502. (III 1.4)

Division III 2

Industrial Branches

Power Generation in the Cement Industry

Using funds from the investment programme for the reduction of environmental impacts, the Federal Environmental Agency subsidised the world's first ORC plant (Organic Rankine Cycle, see photo) for the power generation from low temperature heat in a cement plant. It started operations on 7th May 1999 at the company Heidelberger Zement in Lengfurt. The electricity extraction mainly comprises waste heat sources, heat supply from cogeneration, electricity production and the cooling circuit.

30 percent of the clinker cooling air serves as a waste heat source, having previously remained unused during the clinkering process. A partial waste gas flow with a temperature of 275 °C is now recycled for the electric energy conversion following dust

extraction in an electrostatic precipitator. The power generation in the actual ORC plant consists of a vapouriser and preheater for the drive medium, turbines and the generator. Pentane is used as the drive medium. The new plant covers part of the own electricity requirements of the cement plant in Lengfurt. CO₂ emissions of around 7,600 tonnes per year will be reduced. The ORC technology provides the possibility of using low temperature heat in many sectors – for example the metal and the mineral industries. (III 2.2)

Modern Process Technology in a Foundry

Iron foundries might emit significant quantities of dust and gaseous substances that are particularly harmful to health. The investment project "Reduction of Dust and Gaseous Emissions from a Foundry by Using Modern Process Technology" at Eisenwerke Brühl GmbH in Brühl was sponsored by the Federal Environmental Agency with the aim of significantly reducing these emissions. After renewing the moulding plant, the sand plant and the construction of a cold-box core shop, effective modern waste gas collection and cleaning systems were installed. The emissions of dust, carbon monoxide, nitrous oxides, phenols, formaldehyde and ammonia have been reduced by up to more than 80 %. This project realised a trend setting concept for the production of casting products. (III 2.2)



The world's first Organic Rankine Cycle Plant
(Photo: Heidelberger Technology Centre)

Production-Integrated Environmental Rehabilitation in an Oxichlorination Plant

Oxichlorination is an important process for the manufacture of polyvinylchloride (PVC) fabricated materials. At Buna Dow Leuna Olefinverbund, Schkopau, a low-emissions oxichlorination plant with residual materials recycling was sponsored within the framework of production-integrated environmental rehabilitation. A closed chloro-hydrogen cycle was achieved with the commissioning of the oxichlorination and chloro-hydrogen recycling plant. The emissions were reduced substantially; for example, vinylchloride is no longer verifiable. (III 2.3)

Crude Oil Tank Cleansing

Crude oil is currently stored in Germany in approx. 230 tanks with a floating roof. During the course of the years, a "Slack wax" or crude paraffin is formed. These solid encrustations hinder the five-yearly tank cleansing prior to internal inspection according to § 19 i *Federal Water Act*.

During the cleansing, harmful emissions such as benzene might be discharged. A working group, consisting of representatives of the UBA, the Länder and the oil industry have produced a research report "Decreasing of Emissions and Work Protection During the Cleaning Process of Crude Oil Tanks" for updating state of the art for the reduction of air emissions. If the techniques described are applied, the expected hydrocarbon emissions are less than 0.5 kilograms per square metre of tank floor area. The results are published as a research report of the *Deutsche Wissenschaftliche Gesellschaft für Erdöl, Erdgas und Kohle (DGMK)* under the Number 499-01. It is available from the DGMK, Telephone ++49-40/63 90 04-0. (III 2.3)

Future Environmental Label Requirements for Burners and Boilers

The "Blue Angel" environmental label (see page 127) enables purchasers of oil or gas fired heating systems to identify that a device labelled in this way produces particularly low emissions and saves energy. The requirements which have applied since the beginning of 1998 are currently being further developed. In future the electricity consumption of the heating system will also be taken into consideration.

The new award principles should come into effect from January 2002. (III 2.2)

Solvent-Emitting Plants

Following the passing of the *EC Solvents Directive* (see Chapter 17), an initial suggestion for its implementation into German law has now been produced. It must take into account both the legal systematics of the Federal Immissions Control Act (BImSchG) and the state of the art for installations emitting solvents. Initial discussions have already been held with the associations concerned. A two-year research project for the production of a "BAT Reference Document" (BREF, see Chapter 6) for the solvent sector has been commenced, the work mainly covering the areas of "painting and glueing".

Two research projects have been completed for the "print shops and surface treatment" areas which present measures for reducing solvent emissions and assess the possible reduction potential (Ökopool, Hamburg, and Öko-Recherche, Frankfurt/Main). (III.2.4)

Textile Manufacturing and Textile Finishing

The textile finishing industry is a relevant branch with respect to wastewater due to its high water consumption and the large quantities of chemicals which it uses. The wastewater pipes are still subject to the provisions of the 38th *Administrative Regulation* of 1984 which falls well short of current state of the art. A draft Appendix 38 to the *Wastewater Ordinance* submitted by the "Textile Manufacture, Textile Finishing" discussion circle was subsequently discussed by the Federal Government/Federal States working group for § 7a of the Federal Water Act (WHG) and can now be included in the continued legislation procedure. Apart from banning the discharge of certain hazardous substances, the new version of the minimum requirements, which was brought out against the background of the 6th amendment of the WHG, also includes requirements for wastewater at the place where it arises, before it is mixed with other wastewater and before being discharged into the watercourse. This means that improved internal, production-integrated prevention and reduction measures are required. Therefore, the planned regulations also include those operations, which discharge wastewater into municipal wastewa-

ter treatment works as so-called indirect dischargers. Exceptions to the requirements are provided for existing discharges. (III 2.4)

Biologically Degradable Plastics

Biologically degradable plastics are still a young class of materials. The quantity of products made from these materials introduced to the market to date is still insignificant. An up-to-date investigation by the EU, however, foresees a future market potential of 1.15 million tonnes in Europe. The special property of bio-degradability opens up methods of disposal to these materials which naturally remain closed to conventional plastics: composting or fermentation. It is not seldom, that the business circles concerned deduce a general ecological advantage for biologically degradable materials due to one or other special feature (for example sparing non-renewable resources). The UBA has always contradicted such short-sighted perspectives and has demanded that industry only make statements about environmentally relevant properties based on life-cycle assessments according to the DIN ISO 14 040 ff. series of standards. Because such ecological balancing is still overdue, the UBA has tried for some time to initiate a research project, together with industry, on the ecological assessment of products from biologically degradable plastics of various origins. Unfortunately, the response from industry to this offer has been minimal to date. (III 2.4)

Battery Ordinance and Battery Recycling

Public relations work was continued for the *Battery Ordinance (BattV)* which came into effect in 1998. A research project has been awarded to assess various battery recycling methods as well as to produce a national cadmium balance, the intermediate results of which will be presented in autumn 2000. (III 2.4)

Project Sponsorship "Waste Industry and Rehabilitation of Contaminated Sites"

Since 1976, the UBA has been responsible for sponsoring "Waste Industry and Contaminated Sites Rehabilitation" projects on behalf of the Federal Ministry of Research (BMBF) as project sponsor. The aim is to assist the Ministry in carrying out environmentally relevant projects. In 1999, 148 suggested

Table 21: Volume of grants for projects on the waste industry and contaminated sites 1976–1999 (Figures rounded up or down)

Focus of grant	Amount of grants	
	Million DM	%
Waste prevention and recycling	179.2	22.0
Waste treatment	257.1	31.5
Final storage	75.1	9.2
Rehabilitation of contaminated sites	287.2	35.2
Planning, prognoses	19.9	2.1
Total	815.5	100.0

projects were examined with respect to their suitability for sponsorship, 81 projects were processed with the aim of funding by the BMBF which guarantees more than 27 million DM in grants for over 180 current projects as well as organising three status seminars and six expert discussions. The distribution of this sum amongst the various development areas is given in Table 21. *Seven selected final reports have been published in the "Green-White Series" of the BMBF. They are available from the PR Department of the Federal Ministry for Research: Bundesforschungsministerium, Referat Öffentlichkeitsarbeit, Postfach, 53170 Bonn*

Prominent Focal Areas of Work

The Use of Cleansing Walls for the Rehabilitation of Contaminated Sites. The aim is to verify the cleansing performance and possible areas of use of cleansing walls, which are currently being developed.

These are porous walls which are installed in aquifers and contain materials which act as a catalyst. Pollutants precipitate on these walls. This method opens up new opportunities for the further reduction of costs in the rehabilitation of contaminated sites in Germany. It is planned to regularly inform the public on the status of the activities by means of status seminars.

Combined Research on the "Mechanical-Biological Treatment of Waste for Landfill Sites". The results were presented to the public at a conference held on 7th and 8th September 1999. The investigations were aimed at analysing and assessing processes and products which enable ecologically unobjectionable depositing. Different pro-

cess combinations were tested commercially in four pilot systems: Material size reduction and sieving in connection with processes of aerobic treatment (rotting), immobilisation, fermentation and sterilisation. An important part of the research work was oriented to determining the suitability of the products produced for deposition and their long-term stability as well as the whereabouts of contaminants in the treatment and deposition.

Recultivation of Landscapes Left by Lignite Coal Mining.

The research project of the Finsterwald Research Institute for Landscapes Left by Mining has been completed. The project concentrated on determining suitable measures for the use and on controlling the success of biological and other mass wastes. These included sewage sludge, composts and power station ash for recultivation of the landscapes left by mining.

Combined Research on "Biological Methods for Soil Rehabilitation".

It was verified that the biological cleaning processes developed can be used successfully, not only with small quantities of soil in the laboratory but also for large quantities of soil. In 1998 and 1999, investigations were carried out in three pilot systems in Clausthal-Zellerfeld as to how the explosive TNT can be biologically degraded. The representative trials achieved results which are equivalent to thermal treatment.

Rehabilitation of the Disused Military Sites in Stadtallendorf.

In Stadtallendorf, more than 12,000 people live and work on properties which were formally used for explosives production and were used as residential accommodation and commercial purposes following World War II. The research project demonstrated possibilities for the environmentally friendly and inexpensive removal of typical explosive compounds which get into the soil or remain in decommissioned wastewater sewers. Around 11,000 tonnes of soil have been treated in Stadtallendorf, whereby 7 tonnes of typical explosive compounds – including 300 kg explosives – have been removed to date. The rehabilitation measures make unlimited use of the properties and gardens possible again. In addition, costs for otherwise necessary groundwater treatment plant are avoided. *The final report is available from the Hessian Ministry for the Environment, Agriculture and Forestry, Mainzer Straße 80, 65189 Wiesbaden.*

Division III 3:

Waster and Wastewater Industry

European Waste Catalogue

The European Waste Catalogue (EWC) and the Hazardous Waste List (HWL) have both been in use in Germany since the beginning of 1999. When adopting them as national law, Germany categorised a total 19 additional wastes as hazardous and notified the European Commission. Other member states also notified the Commission of additional types of waste as hazardous. In an initial round of amendments, around 60 items of the EWC/HWL have been altered on this basis. In addition, the Technical Adaptation Committee decided to merge the previously separate EWC and HWL catalogues in a single, joint catalogue and to highlight the hazardous wastes in the joint catalogue (with an asterisk). This joint catalogue should come into force on 1st January 2002.

(III 3.1)

Transboundary Movements of Waste

The quantity of exported and imported waste requiring notification rose once again in the year 1998 – the figures for 1999 are not yet available. The total quantity exported is around 1.38 million tonnes, whereby the export of timber waste to Italy has risen particularly sharply. The majority of the waste was exported to EU and European Free Trade Association countries (EFTA, including above all Norway, Iceland and Switzerland).

Around 0.2 million tonnes of non-hazardous, but nevertheless notifiable waste was exported to Eastern Europe. Export to non-European countries is very low. It constitutes around 1 percent of the total quantity.

The imported quantity is around 0.7 million tonnes, which equates to an increase of almost 30 % compared to 1997. The largest quantities came from EU and EFTA countries, the largest quantities coming from Switzerland, the Netherlands and Luxemburg, each with more than 100,000 tonnes. Imports from Eastern Europe with a share of approx. 2 % and from non-European countries with approx. 0.5 % are comparatively low. Detailed information is given in the "Bericht zur grenzüberschreitenden Abfallverbringung" which is to be published as part of the

TEXTE series. It will be available from the Central Reply Service. (See info box on page 124) (III 3.1)

Landfilling

The disposal of waste in former mines plays a special role in the German waste industry. There are three underground storage sites (UTD) for the removal of wastes requiring special monitoring (so-called special wastes). The quantities of waste stored there in 1998 and 1999 are given in Table 22. Typical wastes which are stored in the UTD at Herfa-Neurode (Hessen), are used hardening salts, dye wastes, plant protection product wastes, residues from industrial wastewater treatment, distillation residues, various solid wastes that contain toxic heavy metals, as well as condensers and transformers with residual contamination of polychlorinated biphenyls (PCB) and PCB contaminated soil.

The spectrum of waste in the UTD at Zielitz (Saxony-Anhalt) is similar, while primarily flue gas purification residues from waste incineration plants were stored in the UTD at Heilbronn (Baden-Württemberg) until mid 1999.

In addition, there are a number of mines in which non-mining wastes are used for backfilling and packing purposes within the framework of mining permits. In 1998, 22 such mines were named, some shut down, some still being worked, plus an unspecified number of disused deep lignite coal workings in Brandenburg and Saxony-Anhalt which have to be drilled from the surface from time to time and pumped full with lignite fly ash to counteract mine sags and earth falls.

(III 3.2)

Incineration of Wastes

During the German Presidency of the Council in the 1st half-year of 1999, the Federal Environmental Agen-

Table 22: Quantities of waste disposed of in German underground storage sites (UTD)

	1998	1999
UTD Heilbronn	51,505 t	50,721 t
UTD Herfa-Neurode	79,494 t	130,800 t
UTD Zielitz	10,935 t	44,500 t
Totals:	141,934 t	226,021 t

cy was involved in producing a suggestion for a *Directive for the Incineration of Wastes*. On 24th/25th June 1999, the Environment Ministers' Council of the European Union unanimously adopted the suggestion as a "Joint Position". It was published in the European Community Gazette on 28th January 2000.

The central components of the suggestion are:

- The summarising of the scope of hazardous and non-hazardous wastes in a single directive. This essentially equates to the scope given in 17th BImSchV;
- The stipulation of new limiting emissions values, primarily for the incineration of municipal waste, essentially corresponding to those given in the 17th BImSchV;
- The first time stipulation of limiting values for the drainage of wastewater from waste gas purification, which go significantly further than in Appendix 47 of the outline AbwasserVV, and
- The stipulation of detailed requirements for emissions reduction in the co-incineration of wastes, which are covered more specifically and strictly than in the 17th BImSchV.

Following consultations with the Parliament, the Directive is expected to be approved at the end of 2000.

Biowaste Ordinance

The *Biowaste Ordinance*, which is into force since 21st September 1998, is to be amended in the short-term because the pertinent industry has objected to limitations in the use of biologically degradable plastics from renewable raw materials.

A suggested amendment by the Federal Government was accepted by the Bundesrat with the limitation that products from biologically degradable plastics must not be collected in biowaste bins. This limitation was not adopted by the Federal Government. An amendment to the Biowaste Ordinance is therefore not to be expected in the near future. Independent of this, the UBA questions the sense of specific composting of biologically degradable plastics.

A Federal Government-Federal States working party, in which the UBA is also involved, is currently producing instructions for the Biowaste Ordinance to enable the Länder to uniformly interpret enforcement of the Ordinance. (III 3.3)

Wastewater Constituents of Wetlands

Wetlands have proven their worth in the treatment of domestic wastewater. It is unclear to what extent permanent operation of ten to twenty years can be guaranteed, because – apart from limitations in use due to organic substances (blockaging of the soil filter) – contaminants might also accumulate in the soil filter. Therefore, horizontally and depth-oriented soil samples were taken from systems with different soils materials and investigated for individual and composite wastewater relevant parameters.

The result: Wastewater constituents are accumulated in wetlands due to transformation, filter and sorption processes as well as precipitation reactions. Depending on the type of system, these distribute themselves in the immediate inlet area, individual horizontal layers or diffusely over the whole system. The material loads are highest where a horizontal layer of dying biomass develops. This leads in part to its classification as waste requiring disposal. Treatment and disposal methods are necessary for "used" soils materials in the case of conversion measures to planted soil filters. According to rough balances, costs must be calculated for this, which can increase the specific wastewater costs after approx. 15 years' operation with maximum 20 Pfennigs per cubic metre wastewater. In addition, structural installations must be provided in the design of the system, which enable temporary discharge of the horizontal deposit and soil filter exchange in the inlet area without damaging the system. *The study, "Verbleib von Abwasserinhaltsstoffen ..." (TEXTE 99/78), is available from the Central Reply Service. (See info box on page 124). (III 3.5)*

No Bacteria from Sewage Treatment Plants

The sewage treatment plant currently in operation display a considerable discharge of microorganisms in the outlet of around 10 to 100 million germs per litre. There is a considerable amount of pathogenic germs and bacteria which are antibiotic-resistant. All microorganisms can be retained with the aid of micro filters in the biological purification stage which prevents the spread of pathogenic germs and multiple resistances.

Due to the air and oxygen intake required in classic biological wastewater treatment, pathogenic microor-

ganisms also get into the atmosphere. In laboratory-scale sewage treatment plant, special filter laminates with a pressure loss of less than 10 cm column water displayed virtually complete germ retention (over 99.7 %). The combination of bio-membrane filtration and waste air laminate filtration thus achieved zero emissions of pathogenic microorganisms. This type of plant is available as domestic and small sewage treatment plant and even as large sewage treatment plant. It is also possible to retrofit existing biological wastewater treatment plant. With respect to wastewater, appropriate requirements will in future be implementable for individual cases via § 41 of the *Protection against Infection Act* (see Chapter 10). With respect to waste air, relevant requirements could be inserted in the amendment to the *Technical Instruction Air*, analogue the requirements for mechanical-biological waste treatment plants. (III 3.5, II 2.4)

low print of the standard, "*Biological Test Methods for Wastewater Monitoring*" is available from the Beuth Verlag, 10772 Berlin. (III 3.6)

Fish Egg Test Instead of Fish Test

Both the *Wastewater Charges Act* and the *Ordinance Regarding Requirements for the Discharge of Wastewater into Bodies of Water* to § 7a of the *Federal Water Act (WHG)* include the acute fish test. This standardised method of testing (DIN 38412-L 31) is used by the monitoring authorities. It is also used in the self-monitoring of industrial operations.

This test is used to determine the dilution of wastewater, at which no fish dies within 48 hours. The regulations of the *Wastewater Charges Act*, in the administrative regulations and in the *Wastewater Ordinance* are matched with each other so that the results of the fish tests can be used for the enforcement of both regulations.

The UBA has suggested the complete replacement of the fish test in enforcement of the water legislation by a "fish egg test". Under applicable national and international law, this test is not considered an experiment on animals. In 1997, at the application of the UBA, a working group was set up at the German Institute of Standards (DIN Sub Committee 7, Working Group 6), which produced and submitted a draft standard in 1999 following successful comparative laboratory tests. This draft was approved by the Standards Committee for Water (NAW I 3) and appeared in April 2000 as a yellow print (DIN). Issue of the final standard is planned for the end of 2000. The European (EN) and international standards (ISO) for the fish egg test will be introduced during 2000. *The yel-*

Department IV: Safety of Chemicals and Gene Technology

Division 1:

Chemicals Safety – Environmental Testing

Environmental Testing of Pharmaceuticals

Since the 8th amendment of the *Pharmaceutical Preparations Act (AMG)* came into effect, the Federal Environmental Agency (UBA) has been the consenting body for environmental protection provisions in the licensing procedure for pharmaceuticals according to § 28 Para. 3 AMG. In 1999, the assessment work was limited to veterinary pharmaceuticals. Work is being carried out on criteria and data requirements for the evaluation of the environmental comparability of human pharmaceuticals which will enable an environmental assessment to be carried out within the framework of the authorization procedure.

In 1999, within its role as a consenting body, the UBA processed 35 applications for authorization for veterinary pharmaceuticals which had been submitted to it by the authorization body of the Federal Institute for Consumer Health Protection and Veterinary Medicine (BgV) due to their environmental relevance. As in most cases, the information submitted by the applicants was insufficient. Subsequent demands had to be made, for example in the form of studies on the environmental behaviour of the active pharmacological ingredients. (IV 1.1)

Detailed reports and background information is available on many of the topics, some of which in English as well. All orders from outside Germany may be directed to the Central Reply Service of the UBA, Bismarckplatz 1, 14193 Berlin, Germany. Fax ++49-30/89 03-2912. A list of all UBA publications is also available from here, free of charge.

New Substances According to the Chemicals Act

The registration and notification obligations for new substances which are brought onto the market in Germany are at the centre of the *Chemicals Act (ChemG)*. The UBA is responsible for assessing the environmental risk of the notified substances in the enforcement of the Chemicals Act.

In 1999, 100 new substances were notified in Germany which are distributed over 13 user groups (Figure 22).

Subsequent requirements were raised for three substances due to faulty or incomplete documents. Risk assessments were produced for 76 substances of these, 41 substances were classified as "dangerous for the environment". They must be labelled accordingly.

The results of the risk assessments are as follows:

- *Conclusion I:* No additional information requirement before reaching the marketed quantity of 100 tonnes per annum (t/a) = 64 substances
- *Conclusion II:* On achieving the marketed quantity of 10 t/a, additional information or test results are necessary: = 7 substances
- *Conclusion III:* Immediate additional information or test results are required: = 4 substances
- *Conclusion IV:* Immediate risk reduction measures are necessary, initiation of dialogue with the notifier: = 1 substance

A total of 327 new substances were registered in the other EU member states. In 1999, 26 substances reached the marketed level 1 (100 t/a) and 3 substances the marketed level 2 (1,000 t/a) throughout the EU. (IV 1.1)

Need for Reform of Assessment of Existing Chemicals

The *EC Existing Chemicals Regulation* is aimed at existing substances which are to be assessed

as a priority due to their particularly hazardous properties, high production quantities and complex use patterns. Existing chemicals are commercially used substances which were on the market before 18th September 1981. They are listed in the **European Inventory of Existing Chemical Substances (EINECS)** of the EU Commission.

The assessment includes a systematic risk assessment and, if the results of the risk assessment show a need for regulation, a strategy for effective and efficient risk reduction.

This approach is intended to provide the political decision-makers with a basis for EU wide risk reduction measures which satisfy the following principles:

- Systematically produced according to generally accepted technical rules,
- Presented in the most transparent and traceable way possible,
- Scientifically justified and based on validated information and
- Accepted due to the technical-scientific discussion of all participants.

The first three priority lists of the EU were published in 1994, 1995 and 1997. In total, they include 110 existing chemicals. The risk assessment of 49 substances is so advanced in the EU that the following results are emerging:

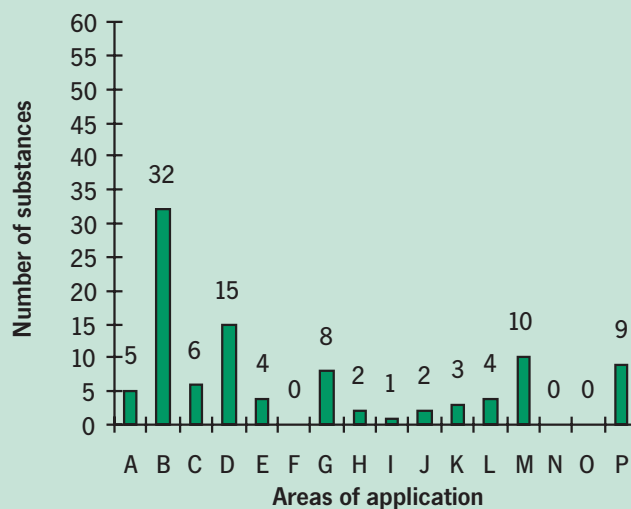
- In the case of three substances, there is no need for further action at present;
- Risk reduction measures are required for 23 substances and
- The data situation for 23 substances should be improved first.

The complete procedure through to publication of the EU Commission's recommendations has only been completed by four substances to date: 2-(2-methoxyethoxy)-ethanol, 2-(2-butoxyethoxy)-ethanol, short-chained chloroparaffins as well as alkylbenzol (C10-C13). The summaries of the risk assessments are available on the internet (<http://ecb.ei.jrc.it/existing-chemicals>).

The assessment status and results for the substances of the 1st priority list examined by the UBA to date (substances with German management) are given in Table 23, page 138.

Figure 22: Number of new substances registered in 1999 arranged according to areas of use

As substances can be registered for several areas of use, the number of substances is not the same as the number of registrations



- | | |
|---|---|
| A: Photo industry | I: Chemicals for use in public spaces, e.g. cleansing agents (professional products), office products |
| B: Chemicals for synthesis processes | J: General chemicals |
| C: Personal use and household | K: Construction and mechanical engineering industry |
| D: Manufacture of polymers | L: Fuel industry |
| E: Cellulose, cardboard, paper | M: Dyes, lacquers & varnishes, paints |
| F: Metal extraction, refinement, working | N: Agriculture |
| G: Textile processing industry | O: Leather industry |
| H: Production of electrical and electronic appliances | P: Miscellaneous |

The risk assessment at EU level was not able to be completed for the four substances methyl-methacrylate, methacrylic acid, acrylic acid and 3,4-dichloroaniline. However, a need for regulation of environmental aspects is already indicated. The UBA has begun to develop appropriate risk reduction strategies. The existing chemicals include 15,000 to 20,000 substances with annual production quantities of between 10 and 1,000 t/a as well as 2,600 substances with production quantities of over 1,000 t/a only in Europe. Given this quantity problem, increased discussions are taking place regarding how the assessment can be accelerated.

The UBA has actively participated in this discussion. The most important points were recorded in the con-

Table 23: Status of execution of the EC Existing Chemicals Ordinance in the Federal Environmental Agency (1st EU Priority list: Substances with German management)

<i>Substance</i>	<i>Draft of the environmental part of the risk assessment by the UBA</i>	<i>Dispatch to the EU (environmental health and occupational safety)</i>	<i>Closing Discussion in the EU (technical level)</i>	<i>Expected conclusions for the environment</i>	<i>Environmental risk classification</i>
EDTA	11/98	-	-	RM/V.d.D.	R 52/53
EDTA Na salt	11/98	-	-	RM/V.d.D.	R 52/53
Aniline	3/96	8/99	-	RM/V.d.D.	N, R 50
Benzol	4/98	-	-	V.d.D.	R 51/53
Acrylic acid	1/96	9/97	9/99	RM	N, R 50
Methyl acetate	9/95	5/98	6/98	k.H.	n.e.
Methacrylic acid	7/95	7/96	9/99	RM	N, R 50
Methyl methacrylate	6/96	7/97	9/99	RM	n.e.
3,4 dichloroaniline	6/96	1/99	9/99	RM	N, R 50/53
4-methyl-m-phenylene diamine (TDA)	9/96	-	-	V.d.D.	N, R 50/53
4,4'-methylenedianiline (MDA)	7/95	3/97	9/98	V.d.D.	N, R 51/53
2-Ethylhexylacrylate	8/96	-	-	V.d.D.	n.e.
DSDMAC	8/95	8/96	6/98	V.d.D.	N, R 50/53
Vinyl acetate	1/96	-	-	V.d.D.	n.e.
Phenol	9/96	-	-	V.d.D.	n.e.
But-2-yn-1,4-diol	8/95	9/96	3/98	k.H.	n.e.
Ethanoic acid ethyl ester	6/95	4/97	3/98	k.H.	n.e.

V.d.D.	Improvement of the data situation required	N	Environmentally hazardous
RM	Risk reduction measures required	R50	Very toxic for water organisms
k.H.	No action required at present	R51	Toxic for water organisms
		R52	Harmful to water organisms
		R53	Can have harmful effects in watercourses in long-term
		n.e.	Not to be classified

clusions of the EU Environment Ministers' Council of 24th June 1999 (EU Council Document 11265/99). The EU Commission plans to present its ideas for the new conception of the European chemicals policy in summer 2000. (IV 1.2)

Authorization of Plant Protection Products (PPP): Lawsuits Rejected

Within the framework of the authorization of plant protection products (PPP) which were able to be brought onto the market by the end of 1998, manufacturers of PPP sued for continued licensing ability at the administrative court of Braunschweig. This was against the background of the new *Plant Protection Act (PflSchG)* coming into force, through which the consenting responsibility of the UBA is extended to include the whole natural balance.

The Braunschweig administrative court rejected the applications of the manufacturers for preliminary licensing of PPP in 13 cases. Due to the retraction of an application, the proceedings were cancelled for one product. In five cases, the licensing body was obligated by a temporary ruling to (temporarily) licence the PPP until a decision had been reached with respect to renewed licensing.

The court decisions in the preliminary process confirm the correctness of the UBA's assessments and

evaluations. It will therefore continue to undertake an expert weighing up of the aims of environmental protection and protection of cultural crops in future too. Plant protection (protection of cultural crops) and environmental protection (protection of the natural ecosystem) are equal ranking protected goods both according to German plant protection legislation as well as the *EC Directive 91/414/EEC*. No culture must be allowed to remain without protection, whereby the needs of environmental protection must be given extensive consideration. The UBA is of the opinion that disputed problems should not be solved by confrontational methods but in an acceptable cooperation between all the parties involved. Therefore, in 1999 the expert cooperation with manufacturers and users in agriculture was continued. (IV 1.3)

Detergents and Cleansing Agents

In 1999, more than 5,500 new detergents and cleansing agents or new compositions of existing brands were marketed in Germany. This takes into consideration all products from the domestic, commercial and industrial sectors, which can get into the wastewater or watercourses following normal use and which have to be notified at the UBA according to the *Detergents and Cleansing Agent Act (WRMG)*; the required data include the formulation of the products. This does not include body care products and cosmetics.

The notifications recorded by the UBA show that at the end of 1999 there were a total of over 23,000 detergents and cleansing agents, notified by about 4,000 companies, on the German market.

In 1999, 345 companies reported products for the first-time. The proportion of foreign companies among those registering for the first time rose from year to year and was over 26 % in 1999.

The examination of the requirements of the Detergents and Cleansing Agents Act is the responsibility of the Länder (States), in which the manufacturer or distributor has its registered office. (IV 1.4)

Pipe Cleaners

Bacteria-based cleaners are frequently offered as pipe cleaners in the commercial and industrial sectors for problematic fat soiling. In a research project awarded to the TÜV for Energy and Systems Tech-

nology in Eschborn, no pathogenic germs were found in the cleaning products investigated. However, practical trials show that an alarming increase in the chemical oxygen demand (COD) and biochemical oxygen demand (BOD₅) can occur in wastewater following use of cleansing products containing bacteria. (IV 1.4)

Division IV 2:

Substance Assessment, Gene Technology

Long and Short-Term Transport of Plant Protection Products

According to the latest knowledge available, plant protection products (PPP) are not only spread by direct spray drift during the application, but also to a comparatively large extent by evaporation of the treated crop from the air and to a lesser extent via the soil. Under certain circumstances, the PPP can travel large distances from the treated area and then, dependent on the climatic conditions, deposit again. Substances which have such characteristics are called persistent organic pollutants (POPs).

As the result of a research project, the Fraunhofer Institute for Environmental Chemistry and Ecotoxicology in Schmallenberg, suggests an atmospheric residence time of two days as the assessment criteria for authorisation by the Federal Environmental Agency (UBA), based on the criteria of the UN Economic Commission for Europe (UN-ECE) and of the Environment Programme of the United Nations (UNEP) for POPs. Wind velocity of 5 metres per second (m/s) means that at a distance of 800 km about half the concentration of the substance concerned is still present. If the residence time exceeds two days and in addition there is both a clear persistence in the soil and a significant bioaccumulation potential (see Chapter 14), authorisation for the PPP is questionable. Initial examinations of over 25 active ingredients showed that the already identified POPs (inter alia dieldrine, DDT and lindane) fulfil the criteria, contrary to the majority of the authorised active ingredients.

The study also contains a suggestion, how short-term transport via the air to adjacent ecosystems

can be calculated and assessed. Dependent on the evaporation rate and the type of culture, the exposure concentration to non-targeted plants in the vicinity of the application area can be calculated (PEC value) and then be compared with an effect concentration (PNEC value) for food intake of wild animals or humans. (IV 2.2)

New Testing Methods for Biological Degradability and Bioaccumulation

In 1999, discussions were held at the UBA between experts from the EU countries and the USA on the process of biological degradation under natural conditions and for bioaccumulation in sediment organisms. With respect to degradation in a water-sediment system, the parties involved agreed that such simulation tests are required for a more realistic estimation of the environmental risk. A suggestion of the UBA for bioaccumulation tests with tubifex worms living in the sediment also met with approval. Important aspects for increasing the scientific reliability of the test systems were produced. Both suggestions should be incorporated in guidelines of the Organisation for Economic Cooperation and Development (OECD). Following revision they must be tested in inter-laboratory tests for their applicability and reproducibility. *The study "Entwicklung und Erprobung eines Bioakkumulationstests ..." (TEXTE 99/2) is available from the Central Reply Service. (See info box page 136)* (IV 2.3)

Execution and Assessment of Mesocosmic Studies

In the assessment of plant protection products (PPP) according to the *EC Directive 91/414/EEC*, a risk can frequently not be precluded based on the results of acute and long-term laboratory tests. So-called microcosmic and mesocosmic studies, in which the effect of the substance on aquatic biocoenoses is recorded under consideration of distribution and degradation are suitable for refined risk assessment. However, there are currently no internationally agreed test guidelines, how such trials should be undertaken and assessed.

Therefore, in May 1999, at the initiative of the UBA, an international workshop "Community Level Aquatic System Studies Interpretation Criteria" (CLASSIC) was held at the Fraunhofer Institute for Environmen-

tal Chemistry and Ecotoxicology, Schmallenberg. The Federal Biological Agency for Agriculture and Forestry, the OECD, the EU Commission and the Scientific Society for Environmental Toxicology and Chemistry (SETAC) were also involved.

Mesocosmic studies use a model biocoenosis of organisms which are subjected to PPP under artificial conditions. Mesocosms which contain sensitive species and use reliable statistical methods for the assessment provide reliable results which can be used without an additional factor of safety.

The actual aim of mesocosmic studies is, according to the *EC Directive 91/414/EEC*, to preclude unacceptable effects on the natural ecosystem. As a result, the participants discussed deducing an ecologically acceptable concentration (EAC). This was defined as the highest concentration without ecologically significant effects. The majority of the delegates supported this concept, nevertheless they failed to reach agreement with respect to the criteria for which effect is ecologically acceptable. (IV 2.4)

Risk to Water from Wastes

Substances hazardous to water in the meaning of § 19 *g Federal Water Act (WHG)* are not only pure substances and preparations, but also wastes. However, they cannot be classified into water hazard classes (WGK, see Chapter 15) on the basis of risk phrases (R phrases).

In a UBA research project, various wastes (sewage sludge, lacquer sludges containing solvents, galvanisation residues, hard coal fly-ash, rotted materials of mechanical-biological waste systems as well as slags and smelt granulate of waste incineration plants) are partially leached out several times with water (eluted) and the eluate investigated in eight different biotests. In addition, the heavy metals and several collective parameters were determined analytically.

All eluates displayed harmful effects in at least several of the ecotoxicological investigations, whereby different tests reacted with a high degree of sensitivity. In the case of multiple elution (up to six times), the toxic effect receded, but did not disappear. Therefore, in general, a longer-term subsequent delivery of toxic components must be assumed. The toxicity in smelt granulates was very low, and significantly high-

er for several sewage and lacquer sludges as well as materials from mechanical-biological waste treatment plants.

A general classification scheme into WGK for wastes was developed on the basis of the eluate results based on the classification system for substances and is to be discussed with experts. According to the results, the wastes investigated are to be termed "slightly harmful to water" (WGK1), some of which lie at the boundary for the next higher water hazard class (WGK2). (IV 2.6)

Genetically Modified Plants

An important task of the UBA in 1999 was to produce a monitoring concept for the environmental effects of genetically modified plants which already have a market licence. In addition, consent was given to 17 applications for release, plus 130 subsequently reported locations.

Monitoring the long-term effects of genetically modified plants on the environment is a suitable instrument to close gaps in knowledge of ecological effects. In addition, the aim is to determine and assess changes in the natural ecosystem and its effects. The UBA, together with the Länder (States), produced the outline principles for a monitoring concept on behalf of the Environment Ministers' Conference which is suitable for implementation by the statutory EC regulations. Initial suggestions for the selection of areas suitable for the monitoring, for which initially selected transgenic plants (herbicide resistant rape and insect resistant maize) and the matching monitoring parameters were produced (see Chapter 16). Monitoring of genetically modified plants should be integrated into existing environmental monitoring programmes wherever possible. (IV 2.5)

Genetically Modified Trees and Shrubs

Due to the worldwide increasing number of releases and their particular environmental relevance (long generation period, spread in natural ecosystems, key species) genetically modified trees and shrubs are increasingly significant.

A research project carried out by the Humboldt University in Berlin, Institute for Biology, investigated the risks and perspectives as well as suitable safety mea-

asures. The results were presented at a specialist discussion in September 1999. The parties agreed genetically modified that if necessary plantation trees should be released, as the risks of the release of transgenic trees in the forest cannot be estimated at present.

The conference material (TEXTE 99/99), is available from the Central Reply Service. (See info box page 136). (IV 2.5)

Central Administration

Division Z 1:

Administration and Project Management

Employees

By the end of 1999, the number of jobs at the Federal Environmental Agency (UBA) had decreased by 1.5 % to 1,032 compared to 1998 (Table 24). As in previous years, the number of female employees continued to rise. The ratios for the various career and salary groups are given in Table 25. (Z 1.1)

Table 24: Posts according to budget plan

Year	Total	Civil Servants	White-collar	Blue-collar
1997	1,057	485	493	79
1998	1,043	476	490	77
1999	1,032	397	556	79

Training

In 1999, the UBA trained eleven school leavers for a job as "administrative assistant". Four trainees have been offered a job. The training primarily took place in the Central Administration. In addition, ten persons received training as "chemistry lab technicians" in other Departments.

Table 25: Ratio of male and female employees

Category	Total number	Male Employees	Female Employees
Higher service (management)	146	125	21
Higher service	331	185	146
Higher intermediate service	303	140	163
Intermediate service	312	65	247
Ordinary service/workers	86	56	30
Summe	1,178	571	607

Furthermore, 15 trainee lawyers and 72 university students as well as four Ecology Year Volunteers were given the opportunity to undergo a period of administrative and practical training in the Federal Environmental Agency. (Z 1.1)

Budget

The UBA had a total budget of around 149 million DM in 1999 (Table 26). The increase compared to 1998 is due to the adjustment of the investments for construction works to the actual schedule. The flexibilisation instruments used for the first time in 1998 within the framework of the Federal Government's reform of budget legislation proved their worth. (Z 1.2)

Quality Assurance in Project Management

The reorganisation of the Agency, which came into effect in August 1999 (see introductory chapter, page 6 ff), also brought a substantial streamlining of structures and procedures in the area of project supervision.

Apart from guidance for research and development projects, there has been no comprehensive documentation of regulations and procedures for the project supervisors. To this end, a manual for technical supervision of special projects/R+D projects was developed.

With this manual, the UBA ensures that task and performance descriptions are available to interested parties in all award procedures in as much detail as possible. This makes it easier for applicants and bidders to draw up appropriate applications and bids.

In the UBA, use of the manual ensures a uniform high level of quality in the technical supervision of projects. This it can be seen as a preliminary stage for a system of quality planning within the framework of a future formalised quality management. (Z 1.3)

Table 26: Federal Environmental Agency budget

	Target 1998 '000 DM	Target 1999 '000 DM
I. Federal Environmental Agency budget		
I.1 Total expenditure	135,142	148,603
Of which		
- Personnel	93,722	95,744
- Investment	8,916	18,634
- Scientific publications and documentation	557	563
- Environmental information and documentation system (UMPLIS)	4,488	4,533
- Data processing	5,423	6,550
I.2 Services requested by Federal authorities and third parties		
- Federal authorities	3,059	2,353
- EU, others	3,043	3,330
II. Managed funds, inter alia for		
- investments towards pollution abatement	25,225	10,150
- Award of research projects (UFOPLAN)	46,046	45,625
- Environmental specimen bank	8,180	8,770
- Grants to associations and other groups		
- Institutional support	3,583	3,583
- Project support	8,309	9,147
- Environmental publicity	2,457	2,393
- Consulting for the countries of the former Soviet Union and for Central and Eastern European countries	1,281	689
- International cooperation	1,083	1,775
Total managed funds transferred	96,164	82,132

Division Z 2:

Documentation, Data Processing and User Care

The IT Platform of the Agency

UBA has a modern, distributed information technology (IT) infrastructure to be able to carry out its many tasks (Figure 23). Information management is no longer imaginable without this technology. In 1999, the gradual, complete furnishing of the individual workplaces with personal computers (PCs) according to their requirements was completed. The avail-

able services are realised in multiple-stage client-server architecture. All UBA locations are connected to each other via a fixed line. Small field offices of the measuring network are reached via dial lines. The selection of the software is oriented to current developments in internet technology. This ensures far-reaching linkage to a wide range of research relationships.

The servers are operated with WindowsNT-Server and Unix operating systems. Powerful central servers provide the central services, such as large databases and computation-intensive models. Local or dedicated servers secure the distributed services.

Table 27: Development of the ULIDAT, UFORDAT, and URDB Databases

Database	Inventory (Data sets)	Growth in 1999 (Data sets)
ULIDAT	372,000	32,000
UFORDAT	62,000	5,000
URDB	21,600	600

The network allows access to the intranet of the UBA (UBAnet). Information exchange with research partners is via a firewall as well as using the variety of possibilities offered by the Internet. (Z 2.3)

Sustainable Development and the Information Society

During the course of the last few years, information and communications technology has penetrated the personal and working rhythms with such a speed and depth that the IT division of the UBA has begun to consider this technology critically. Under environmental aspects, the growth of the information and communication technology is ambivalent.

Possible significant environmental alleviation potential are counterposed by significant negative environmental effects. A differentiation must be made between two levels: the information and communication technology products and the fields their application. Against the background of these considerations, a workshop was held in September on the "Sustainable Development of the Information Society". Development trends and innovation directions on this market, ecological requirements, the role of the UBA in this sector and a possible overall strategy were discussed.

The expectations placed in UBA are high. Until now, there are no binding orientation marks for sustainable information technology. An important requirement was the production of a "roadmap". In a roadmap, central problems of the branches can be shown, technical challenges named and routes to solving them indicated. A roadmap, which is produced by the companies in a branch in cooperation with the players from science and politics enables individual topics to be bundled and common priorities to be set. A roadmap opens new perspectives for a sustainable information and communication technology in environmental protection. In the

meantime, an initiative of the parliamentary parties in the German Bundestag aims in the same direction.

The conclusion of the "Strategy for a Sustainable Information Society" is available free of charge from Section Z 2.2. (Z 2.2)

Hypermedia Technology for Environmental Data

The UFOPLAN project on "Hypermedia Technology for Environmental Data (HUDA)" that commenced in 1996 was successfully completed. In cooperation with the State of Baden-Württemberg, a toolbox was developed from individual software products, with the help of which a complex structured document such as the report "Data for the Environment" can be produced in a printed version, on CD ROM and online. The next environmental report of the state of Baden-Württemberg and "Data for the Environment 2000" are planned to be produced using HUDA. Other Federal States have already registered their interest. (Z 2.1)

Rapid Hazardous Substances Information

As a forerunner of the GSBL (see Chapter 2), the Rapid Hazardous Substances Information (GSA) has been in operation since 1989. Around 100 external online users are currently registered, including governmental and municipal environmental agencies and fire service control centres.

Approximately 8,600 substances can be researched. In 1999, 2,500 substances enquiries were received by the GSA and answered. (Z 2.4)

Geo-Thesaurus

The Geo-Thesaurus is a product which has been created from the overlap of official geobase data of various authorities (Federal Office for Nature Conservation, Federal Agency for Water Studies, Federal Office for Cartography and Geodesy, UBA) with tools of a geographic information system (GIS). To this end, the GIS software components Arc View Internet Map Server (AVIMS) were also used, so that the user can now submit a spatial enquiry. Thus, in 1999, a prototypical solution for the Internet use of the "GIS environment" (GISU) was completed.

ternal users in the Berlin premises on Bismarckplatz and on Corrensplatz as well as in Bad Elster within the usual working hours.

In 1999, the library increased its inventory by 10,000 to around 359,000 volumes. Around 800 magazines on environmentally relevant topics are kept. However, for budget reasons, 200 magazines have had to be cancelled.

The library's services were used by around 24,000 users. 30,000 monographies were borrowed, around 9,300 constant, external users are listed in the user register.

The number of usages of the magazine inventory in offices in terms of magazine circulations is around 60,000.

The library is kept up to date inter alia by an extensive document exchange with around 400 exchange partners in the Federal and State authorities, and scientific institutions both at home and abroad.

(Z 2.6)

Library and Computing

To support the most important library business functions, the library administration system was developed aDIS/BMS developed with the aDIS software is used: It has a modular structure, integrates a large number of different databases and thus allows continuous processing of the literature and magazine inventory.

Apart from the monthly new purchase list for over 100 individual users and institutions, around 20 selected bibliographies on topics such as ecobalancing, environmental policy and sustainable development are printed off from the BIBLIODAT library database or made available online. Apart from the online library catalogue (OPAC), additional research computers are also available to the users, which can be used to access the aforementioned environmental literature database ULIDAT as well as selected CD ROM databases.

(Z 2.6)

President's Office/Press Office

In 1999, the Federal Environmental Agency achieved the most response from the media with the topics "ecological tax reform" and "summer smog". The UBA also received many enquiries on the topics "traffic" and "energy", for example on the liberalisation of the electricity market, potential energy savings, and climate protection. In addition, genetic engineering and biotechnology, the risks of chemical substances and plant protection products are increasingly the focus of media interest.

In 1999, the UBA celebrated a special anniversary. Numerous newspapers, magazines, radio and television broadcasters reported on the event. The brochure especially produced for the Agency's birthday says it all: "25 Jahre – and kein bisschen leise. Ein Vierteljahrhundert Umweltbundesamt." ("25 years of age – and not silent at all. A quarter century of the Federal Environmental Agency").

In total, around 4,300 written and telephone enquiries were received by the press office. Following an unusual increase to around 6,100 enquiries in 1998, the number is now back to the level of the previous years (Figure 24). There has been a marked increase in the number of interviews: UBA staff appeared 330 times to answer questions on both radio and television (1998: 214). In addition, there were 55 interviews and short contributions to print media (1998: 39).

In total, 97 press releases were sent by post, fax and e-mail (1998: 67). The development is shown in Figure 25. Apart from numbered press releases, which

are sent out via all press distributors, dedicated press releases with specific content are also sent to selected special interest media. This guarantees that certain target groups are reached directly. All press releases since 1996 are available on the Internet (<http://www.umweltbundesamt.de>, English pages, menu item "Press"). (PB)

Figure 24: Number of press contacts 1990–1999

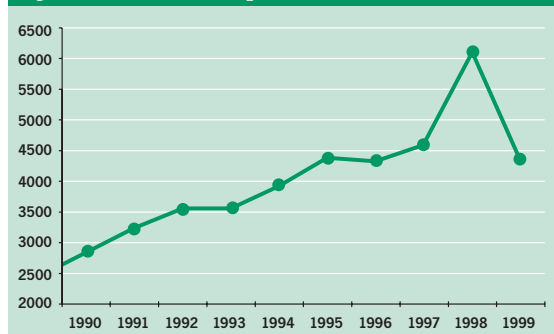
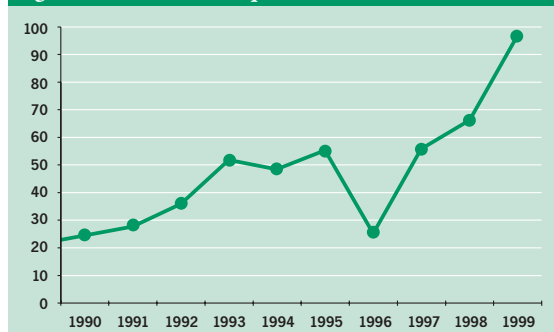


Figure 25: Number of press releases 1990–1999



Build-Up Staff for Dessau

The work for relocating the Federal Environmental Agency to Dessau (see page 6 also) is advancing briskly. Problems that had arisen regarding the transfer of liability, the costs and financing the rehabilitation of contaminated sites at the location were successfully solved in April 1999 with the signing of a public-law agreement between the town of Dessau and the state-owned real-estate company TLG. Thus, the green light was given for the continued determination of the background information for the realisation of the UBA head office in the Dessau Gas Quarter. The further planning steps were undertaken thoroughly and quickly.

At the start of the year 2000, sauerbruch hutton architects (sha) and participating engineers were able to submit a preliminary design which is the basis for the continued planning. It implements the requirements of the building not only with respect to spatial-functional aspects, but also regarding the building ecology aims. At the same time, a draft guide for

“sustainable building”, which the Federal Ministry of Building and Housing submitted, is to be applied in this process in an exemplary way.

The central building ecology elements of this draft are, inter alia:

- Increased building thermal insulation that are over 40 percent less than the values required by the Thermal Protection Ordinance,
- Reduction of the annual electricity consumption to a value of around 30 to 35 kilowatt hours (kWh) per square metre gross floor area (50 to 100 kWh are usual),
- Reduction of the cooling requirement by utilising the building mass for cooling overnight during the summer,
- Use of geothermal energy heat exchangers for reducing the amount of energy required for heating and cooling,
- Use of regenerative energy sources for energy supply, including solar-assisted cold production, landfill gas utilisation, gas-operated fuel cells, photovoltaics,
- Ventilation concept based on natural ventilation, which simultaneously takes into consideration the significant noise immissions from the planned northern entrance and the rail traffic,
- Use of environmentally and health compatible construction materials such as clay, halogen-free cables, etc.

In summer 2000, the draft design and approvals planning will have been completed with the submission of the budget construction documents.

Figure 26 shows a draft landscaping plan. The rehabilitation of the old Wörlitz railway station as part of the overall project commenced at the end of 1999 and will be completed in August 2000. The build-up staff of the Agency and the Vice President will then be based in Dessau. Parallel to this, the model project will be presented for the World Exhibition EXPO 2000. (AS-DE)

Figure 26: Landscaping plan of the new building



Source: Büro ST raum a, Berlin