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Foreword

There is often talk that environmental protection is no longer an issue of public debate. I believe that this is exaggerated. Unemployment or domestic security may certainly be more topical than environmental protection. However, debates on future energy and agricultural policy, ecological tax reform, genetic engineering, mandatory deposits on bottles, the HGV toll and sustainable development show that environmental protection is still an important aspect of public debate. Once again in 2001, the Federal Environmental Agency in its capacity as the scientific environmental authority in the Federal Ministry for the Environment has contributed a host of topics to expert and public discussion. This does not mean that we took an isolated approach to environmental protection. This issue is linked to consumer protection and the protection of human health. Strict separation of these areas is seldom possible. The Federal Environmental Agency, for example, together with motorists and environmental groups advocated the introduction of particle filters for cars in order to eliminate minute, harmful soot particles from Diesel exhaust emissions.

We are pleased to report that a much-neglected area of environmental policy became the subject of greater public attention in 2001, i.e. soil protection and, above all, land use. Every day, around 130 hectares of land is additionally taken up and used in Germany for transport and settlement. Although there is no reason to fear that Germany will sink in concrete, these areas which serve as a natural habitat for man, animals and plants are lost – often for all time. This is

why the Federal government is determined to reduce the additional daily land use to 30 hectares. This task requires considerable patience because we must fundamentally re-think our planning policy and create incentives to consume less land.

It is not surprising that the Federal Environmental Agency once again in 2001 invested considerable efforts in all aspects of “climate and energy policy”. The already apparent climate change is an enormous

challenge for national and international policy. Energy policy is the key to climate protection because the majority of climate-damaging emissions are generated when we produce and use energy. This means answering one particular question: Which type of energy are we to use where and to what extent, so that we can avoid permanent climate damage? One response to this question is that we are promoting the expansion of renewable energy sources, such as wind, biomass, solar and geothermal energy which have no negative repercussions on climate. But this also means that we must attempt to save energy and use it rationally whenever possible.

Finally, a few words on our own behalf: The Federal Environmental Agency is the first Federal authority to take part in the EU eco-audit programme. TÜV Nord confirmed that the Federal Environmental Agency employs a functional environmental management system pursuant to the EU Environmental Audit System (EMAS) and the ISO 14001 standard for its headquarters at Berlin's Bismarckplatz. We are proud to bear the EMAS logo. We were amazed to discover that even more environmental protection was possible in many areas at the Federal Environmental Agency. We are further perfecting our environmental management efforts and are determined to introduce this system at the agency's other offices.

Environmental management at the Federal Environmental Agency is one element of the agency's modernization. The general conditions for Federal administrations have been set: Fewer employees, less money and ever-growing tasks. There is no doubt that the Federal administration needs to be modernized as decided by the Federal government in its "Modern state – modern administration" programme. The Federal Environmental Agency has been implementing modernization measures for some time now. Apart from the environmental management system, these measures also include cost and performance accounting as well as elements of solid personnel development. This helps to boost motivation, to reduce costs and to effectively work with the staff available. This means tough challenges for staff throughout the Federal administration. We are determined to run the Federal Environmental Agency in a sustainable manner in order to meet with the growing requirements of the future. Finally, our aim is to ensure that environmental protection remains a focus of public attention, becoming a natural part of everyday life.

I hope you have a good read.

Prof. Dr. Andreas Troge
President

Portrait: The Federal Environmental Agency – Diversity and Quality

Overview

- Start of construction for future headquarters
- Who we are – what we do
- Modernization at the Federal Environmental Agency
- Environmental management at the Bismarckplatz headquarters
- Gender mainstreaming

Start of construction for future headquarters

After the agency opened its offices at the historical Wörlitz railway station in Dessau in October 2000, the relocation of the Federal Environmental Agency (UBA) to the Federal State of Saxony-Anhalt entered a new stage: The planning phase for the construction of the new headquarters is largely completed.

Preparations for the new building in Dessau's "Gasviertel" district started in spring. The engine shed was dismantled stone by stone and will be rebuilt at another location. The post shed was pulled down. First construction contracts were signed. Construction work is set to commence in spring 2002. The foundation stone will be laid on 10 April 2002 (refer to page 183 for details).

(AS DE/Z 1.5)

Who we are – what we do

The Federal Environmental Agency (UBA) was set up by law on 22 July 1974 as an independent supreme Federal authority with headquarters in Berlin. Parts of the Agency will move to Dessau. This is scheduled for 2004. The UBA is responsible for the following tasks:

- Providing scientific support to the Federal Ministry for the Environment (BMU) in the fields of immission and soil protection, waste and water management and with regard to health issues in environmental protection. This applies in particular to the preparation of legal and administrative regulations.
- Performing research and developing foundations for suitable measures and testing and examining methods and equipment.
- Setting up and managing an information system for environmental planning as well as a central environmental archive; measuring large-scale air pollution; informing the public on environmental issues.
- Providing central services and assistance for departmental research and co-ordination of environmental research by the Federal Government and supporting the Federal Government when it comes to examining the environmental compatibility of measures.

In order to fulfil these tasks, the UBA also carries out its own scientific research. The Agency is also responsible for a further series of functions (see box on page 7).

In order to meet with its international obligations, the Agency is represented in 339 committees; 70 in the United Nations (UN), 27 in the Organization for Economic Co-operation and Development (OECD) and 118 in the European Union (EU).

The UBA depends on a variety of contacts in order to perform its tasks. This wide range covers scientific institutions and organizations, memberships in a host of committees, as well as meetings with other public agencies and associations (such as industry and environmental associations). Exchanging experience with members of parliament is just as much part of our work as joint research initiatives with other research institutes and promotion societies. The Agency's scientists are actively involved in lecture and discussion events held by educational institutions and political foundations. Thanks to these contacts, co-operation projects were repeatedly agreed to and initiatives triggered. *(I 1.1)*

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

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

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

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

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

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

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

"Health and Environment" action programme, hosting the office of the pertinent co-ordination group between the Federal Office for Radiation Protection (BfS), the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV), the Robert Koch-Institut and the UBA

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

Office "Storage and Transport of Substances Hazardous to Water"

Information and documentation office for substances hazardous to water

Contact office for matters related to the *Basle Convention (Convention on the Control of Transboundary Movements of Hazardous Wastes and their disposal)*

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

ZEMA Incident Notification Office

National reference laboratory for the EU for monitoring air pollution

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

Implementation of the law against *Air Traffic Noise*

Office of the "Environmental Information Systems" work group of federal and federal-state governments

Co-ordination office supporting the tasks of the joint central substance data pool of federal and federal-state governments (GSBL)

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

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

Performance of tests within the scope of Section 18 of the *Federal Law on Epidemic Control*

Tasks in conjunction with the European Environment Agency (EEA):

- German contact office (co-ordination of German participation)
- German contact office for the fields of air quality, air emissions, inland waters, seas and coastal environment, soil and waste
- "Climatic Change" sub-group of the European topic centre on air and climate change

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

Modernization in the UBA

As early as 1990, the Agency set up a work group "16 years UBA" in charge of its modernization. With broad-based involvement on the part of Agency staff, a host of modernization proposals was developed for the further development of its organization, its self-understanding, its human resources policies, human resources development and the Agency's focal tasks. Many of the very concrete proposals have already been implemented.

The UBA's modernization is intended to boost the Agency's efficiency against a background of an annual 1.5 % layoff rate over a period of many years. In order to increase the UBA's efficiency, the scope of its services must be meticulously adapted to its tasks, a reliable framework of general conditions must be developed with a medium-term perspective, and streamlining potentials must be used. This is only possible if people are happy with their jobs.

In 2001, the individually defined sub-projects were developed further.

Personnel development: Personnel development is to create suitable conditions for all employees in order to ideally enable them to perform the Agency's services. Personnel development is to improve personnel assignments in a reproducible, understandable and equitable manner.

"Feedback for executives" is an important element of this approach. During a pilot phase, employees are given the opportunity to assess their superiors who take part on a voluntary basis. This initially involves 14 executives. The aim is to provide these executives with important information concerning the effect of their leadership and to trigger self-reflection. Given a positive response to this trial, this instrument will be introduced throughout the entire UBA.

At times of increasingly restricted hiring conditions in public administrations, further qualification of the institution's own staff is becoming increasingly important, in particular, among executives. The principles to be adopted in the UBA to this effect were discussed among the whole workforce and in workshops. Starting 2002, these principles will be generally applicable at an Agency-wide level.

The UBA is making use of the possibilities offered by the revised public service employment act by granting so-called performance elements to particularly dedicated high-performers. This means that rewards and bonuses can be granted to a certain extent as instruments for boosting motivation.

The detailed evaluation of the results of a trial that was started in 2000 for the introduction of teleworking jobs for 15 employees showed a positive outcome. Another 10 teleworking jobs were set up in 2001.

Health development: In view of increasing demands, an ever shorter supply of jobs and a growing number of tasks, strengthening the workforce's creativity and motivation has become a crucial issue. Health development is one way of making the UBA a modern and effective public agency. Health development is particularly important against the background of changing work conditions (such as work contracts for a limited term, part-time work and teleworking), the growing average age of the workforce, as well as layoffs.

In 2001, the work group on the "Implementation of the Labour Protection Act, Health Prevention" scrutinized the staff's health-relevant working environment. The working conditions were assessed for 920 workplaces. The measures identified as necessary were launched and completed to the greatest part.

In 2001, the work group organized the first full-time health day at the UBA. It served as a forum for the UBA's staff, offering lectures and discussions on healthy diets, addiction problems, ergonomically correct working attitudes and stress reduction. Information booths from health insurance companies and the company doctor's service provided further health prevention information, as did a model workplace designed in accordance with industrial safety requirements and a computer-based program on healthy sitting posture.

A project for assessing psychological stress at the workplace will be carried out within the scope of a contract signed in 2001 with the Institute of Industrial Medicine at the Dresden Technical University. University staff will carry out a comprehensive poll of the UBA's workforce at the Langen and Bad Elster field offices. Possible improvements will be analysed and implemented as a result of this study.

Organization development: The ongoing development of the organization was an important element of the UBA's modernization in 2001. Following a programme that was launched in 2000 for assuring the quality of the new organization set up in 1999, the organization was further developed step by step in 2001, with the modifications coming into effect on 1 January 2002. What this actually means is:

- Concentration of the environmental focus tasks "Energy" and "Climate Protection" in Department I 2 "Legal, economic and sociological issues related to the environment, energy and climate".
- Stabilization of the Langen branch by bundling the experimental development, standardization and measuring tasks for air-borne environmental pollutions and the organizational concentration of the tasks of the branch in Department II 6 "Air quality".
- Response to the forthcoming implementation of the *Kyoto Protocol to the United Nations Framework Convention on Climate Change* by setting up an independent unit II 6.3 "Emission situation".
- Setting up an independent section Z 1.5 "Construction and technology" in order to bundle the many construction and rehabilitation projects on the Agency's properties and to improve the commercial property management situation.
- The merger of the tasks "Existing substances" and "New substances" to form the new Unit IV 1.1 "General issues of chemical safety, environmental assessment of existing and new substances" reflects the Agency's response to the forthcoming new EU chemical substances legislation.

However, this does not mean that quality assurance of the new organization is complete. Ongoing scrutiny of structures and processes of the organization will remain a precondition for adequate organization development. *(Z 1)*

Computer-based knowledge sharing and process handling: As a sub-project within the scope of UBA's modernization, the introduction of an IT-based knowledge sharing and process handling system is planned. In order to identify the suitable conditions for this, the Berlin-based consultancy firm INFORA GmbH was commissioned with the additional involvement of an UBA work group. The project was completed in December 2001 and supplied usable results that can be adopted as a basis for deciding whether or not this project will be continued. *(Z 1.6)*

Environmental management at the Bismarckplatz headquarters

As a supreme Federal authority with comprehensive responsibility for environmental protection, it was a matter of course for the UBA to assume a pioneering role within the Federal administration by taking part in the European EMAS (**E**co-**M**anagement and **A**udit **S**cheme). As a first step, EMAS was introduced at the headquarters at Bismarckplatz (refer to the 2000 annual report). On the basis of an environmental assessment that was concluded the year before, the direct and indirect environmental aspects of the operations were analysed and assessed. Target-orientated measures for saving energy, reducing traffic-related emissions and improving the availability of environmental data were adopted in the form of an environmental programme. The agency's procedures and operations were analysed with a view to their environmental relevance. All the environment-related guidelines and directives were made available to staff in the form of a clearly structured and task-orientated environmental management documentation on the agency's intranet.

With the successful conclusion of the audit by the chartered environmental auditor of the TÜV CERT certification body and the location's registration in the official EMAS register in conjunction with certification of the environmental management system in accordance with the DIN EN ISO 14001 standard, the implementation phase was concluded in September 2001 following the coming into effect of the amended EMAS directive (EMAS II) (Figure 1, page 10).

Details of this can be found in the environmental declaration 2001 [1]. Furthermore, the UBA is involved in experience-exchange programmes and issues technical publications aiming at a widespread introduction of environmental management and environmental controlling by other public agencies.

Besides the implementation of the environmental programme at the Bismarckplatz location, plans exist to introduce the environmental management system at the Agency's Berlin-Spandau location as a next step in 2002. Preparations for this have already been underway since the end of 2001.

(Environmental management officer/I 2.2)

Figure 1: Double accreditation: EMAS and ISO 14001

Gender mainstreaming

For many years, the UBA has employed a gender mainstreaming officer and two deputies – in view of the number of employees and branches as well as measuring points distributed all over Germany.

In 2001, the gender mainstreaming officer and her deputies took part in working groups of the Agency dealing with the UBA's modernization and the prospects for the agency and its staff. These included the work group on human resources development, the work group on health protection at the workplace, the further qualification committee and the work group on the relocation to Dessau. In their capacity as gender mainstreaming officers, they were also present during many hiring interviews.

Further training is an important instrument that benefits gender mainstreaming. Once again in 2001, the UBA's further qualification programmes met with strong interest – including five woman-specific training seminars dealing with persuasion strategies and the development of rhetoric abilities for women in their professional lives. This time, these three-day seminars were also held at the Bad Elster and Langen branches.
On the **GENDER MAINSTREAMING** issue, a seminar was held under the motto: "Communication and co-operation of women and men in the team". The lecture by Prof. Dr. Doris Krumpholz from the Düsseldorf Technical College dealt with new aspects of socio-psychology on gender-specific differences in communication behaviour. This information is helpful when it comes to improving co-operation between male and female staff at the Agency. The seminar will be repeated in 2002 due to strong interest.

By December 2001, the gender mainstreaming plan was drafted for the period from 2001 to 2005 under the supervision of the gender mainstreaming officer. Following discussion and agreement with administration, staff council and the Agency's executive management, the gender mainstreaming plan came into effect in spring 2002.

(Gender mainstreaming officer)

[1] Free copies of the "2001 Environmental Declaration for the Bismarckplatz 1 Location" are available from the UBA's Central Services Unit (address on page 2). It can be downloaded on the Internet at www.umweltbundesamt.de.

Part 1

This year's key topics

1. Towards sustainability: scenarios, aims and local activities

Overview

- Introduction
- The second UBA future study
- Sustainable communal development and Local Agenda 21
- Cities on the road towards sustainable mobility
- Sustainable water supply
- Environmental quality targets and indicators for environmental policy
- The Alpine Convention – shaping a systematic discussion on targets and indicators

Introduction

The 1992 United Nations Conference on Development and the Environment in Rio de Janeiro (Brazil) triggered some of the most important trends in environmental and development policies of the past decades. The results of this conference, notably the so-called Rio Declaration, the AGENDA 21 plan of action, and the global conventions on climate and biodiversity, have changed the political agenda – at a global, regional and local level. The concept of **SUSTAINABLE DEVELOPMENT** proclaimed at the conference has since been coining co-operation in the fields of environmental and development policies.

The World Summit on Sustainable Development which will take place from 26 August to 4 September 2002 in Johannesburg (South Africa) – 10 years after Rio – will provide an opportunity to review the past and to trigger new ideas. This summit is to bring about action-orientated decisions and to respond to new opportunities and risks that have arisen since Rio, in particular, the rapid globalization of the world economy.

The summit will focus on the following issues:

- Fighting poverty and protecting the environment
- Protection of resources and resource efficiency
- Globalization and sustainable development
- Finance and technology transfer
- Strengthening the United Nations' structures for the environment and sustainable development

Germany has developed a national sustainability strategy – as its contribution towards the World Summit on Sustainable Development [1a]. This strategy shows ways and perspectives for a future-enabled Germany in the 21st century on the basis of 21 aims and indicators. The federal government has set up two committees in this context: a State Secretaries' Committee and the Council for Sustainable Development. In December 2001, the State Secretaries' Committee for Sustainable Development submitted a draft strategy for sustainable development. The Council for Sustainable Development has launched the social dialogue on this issue. It works as an advisory body for the federal government and develops proposals for implementing the strategy.

Sustainable development is inconceivable without the active participation of cities, municipalities and administrative districts. In recent years, many federal states, municipalities and regions have set up and in part even implemented programmes and projects for sustainable development.

The second UBA future study

The Federal Environmental Agency (UBA) is making its own contribution towards this growing process. The UBA's first future study from 1997 titled "Sustainable Germany – Ways Towards Long-term Environmental Development" [2] was based on the concept of sustainable development which was worked out in greater detail in several steps. Using three scenarios and with the year 2010 as the time horizon, this first future study looked at energy use, food production, mobility, material flow management and consumption as fields of action which were analysed with regard to their sustainability, whilst their potential for sustainable, i.e. long-term environmentally

compatible development, was studied under different framework conditions. The most important result of this study was the understanding that sustainable development is only possible on two conditions: What must happen is:

- the materials used and the production methods in place undergo an efficiency revolution and
- people's attitudes and behaviour change fundamentally.

In February 2002, Federal Minister for the Environment, Jürgen Trittin, and the President of the Federal Environmental Agency, Prof. Dr. Andreas Troge, presented the UBA's second future study. "Sustainability in Germany – creating a lasting, environmentally compatible future" [3] is based on the understanding that economic growth and hence welfare are only possible within the options that nature provides as the basis for our subsistence. The capacity of the natural balance must hence be accepted as the ultimate, insuperable barrier for all of mankind's activities. The only question is thus how mankind can make the most of the remaining scope for action. This means that a fixed ecological framework is vital in which business and society can develop.

It is the task of policy-makers to define environmental quality goals and to set a legal and economic framework as the course within which the ship of economic and social development can manoeuvre in order to avoid threatening the foundation for life of future generations. This ship is free to sail within given limits, however, without deviating from its course.

The new study reviews the past five years and discusses the further steps to be taken by business and society on the road towards sustainable development. It deals with the fields of action already studied in 1997 in greater detail and adds a number of new issues: tourism, industrial production and the conservation of resources. The review indicates that the present situation in all of these areas fails to comply with the requirements for sustainable development.

The use of the environment resulting from the satisfaction of our demand for energy, food, mobility and other consumer goods is still far too high. The consumption patterns and lifestyles predominant in the industrialized nations cannot persist in the long run – unless for a few at the expense of others. This is worsened even further by the fact that many densely populated developing and newly developed nations are trying to adopt these non-sustainable consumption and lifestyle patterns.

Although individual nations alone cannot ward off global hazards, such as the greenhouse effect, pollution of the oceans and loss of biodiversity, all nations together must take concrete steps in order to make sustainable development possible. Germany as one of the major industrialized nations has a particular responsibility to bear. It can and should assume a pioneering role.

Sustainable development: *Sustainable, environmentally compatible development. This is understood as environmentally and socially compatible development that leads to a balanced relationship between ecological, economic and social factors on a global level and across generations.*

Four fundamental rules apply for living and working in a sustainable natural balance:

- The long-term use of a resource may not exceed its regeneration rate or the substitution rate of all its functions.
- The long-term release of substances may not exceed the tolerance limit of environmental media and their assimilation capability.
- Hazards and unreasonable risks for man and the environment due to anthropogenic influences must be avoided.
- The time scale of anthropogenic intervention in the environment must be reasonably related to the time which the environment itself requires for a stabilizing response.

The transition to a lasting, environmentally compatible development is strongly contingent upon whether environmental, economic and social aims can be successfully combined with each other. Alternative scenarios – rather than forecasts – were developed for the fields of action selected for the UBA's future study. In contrast to forecasts, which could fake determinism, scenarios do not claim to describe inevitable trends. On the contrary – by focusing on the underlying set of boundary conditions, they also show the existing range of options.

The UBA's future study looked at the selected fields of action on the basis of the following scenarios:

- A status-quo scenario where current trends are extrapolated, or, to put it simply: What will happen if nothing happens?
- An efficiency scenario postulating a clear improvement in the technical efficiency of products and production processes – "technical progress will solve all problems".
- A sustainability scenario assuming changed social conditions and an individual understanding of values.

In the following, three subjects will be discussed in more detail: i.e. use of energy, food production, and mobility.

Energy use: Energy efficiency in Germany has improved considerably in recent years. Economic growth and energy consumption now follow separate trends. However, present energy consumption levels and hence emissions of climate-damaging carbon dioxide (CO_2) are still far too high. Furthermore, Germany's energy supply is still largely dependent on exhaustible fuels, i.e. coal, brown coal, mineral oil, natural gas and uranium. The share of renewable energies in primary energy use was as low as 2.1 % in 2000.

Neither under the conditions of the status-quo scenario nor under those of the efficiency scenario will it be possible to achieve sustainable development by the year 2030. In the efficiency scenario, electricity consumption can be stabilized, whilst the demand for energy can be reduced by one third. However, the climate protection aim of an 80 % reduction of CO_2 emissions in industrialized nations by the year 2050, which several specialist institutions consider necessary, will not be achieved.

Unlike the efficiency scenario, the sustainability scenario assumes that significantly more far-reaching measures will be taken and that an increased change in awareness and values will take place. Electricity consumption can be reduced by 20 % between 1998 and 2050, with renewable energies accounting for fifty percent of energy supplies by that time. This means that the climate protection aim can be achieved with this scenario.

Food production: In 2001, a critical discussion on food production methods was triggered in Germany as a result of the emergence of bovine spongiform encephalopathy (BSE, "mad-cow disease"). Apart from food quality and safety, ethic and ecological aspects are also playing an important role in this discussion. Consumers are now starting to take a more critical look at the food production sector.

Environmental burdens related to food production are, first and foremost:

- Nitrogen burdens of soils, waters and forests, caused primarily by conventional agriculture.
- Phosphate oversupply of soils and nutrient burdens of waters resulting from fertilizers of animal origin as a consequence of regionally excessive livestock numbers.
- Pollutant immissions into soils and waters through fertilizers and plant protection agents.
- Soil erosion, structural damage and loss of biodiversity.
- Acceleration of the greenhouse effect.

The food industry, for its part, burdens the environment with large amounts of waste water, production residues, as well as emissions of air pollutants and odours. Further environmental pollution results from the use of problematic auxiliary materials and substantial volumes of packaging materials. Transport processes and the resultant emissions related to the production and distribution of foodstuffs also have a strong polluting effect on the environment.

If current trends in the status-quo scenario were to continue, the environmental situation can be expected to deteriorate further in most areas. Although the scientific and technical progress which is assumed in the efficiency scenario can reduce the pollution caused by fertilizers and plant protection agents, it cannot improve the situation in terms of loss of land, loss of biodiversity and biotopes, as well as soil erosion.

In the sustainability scenario, the environmental situation improved in almost all environmental sectors. Important approaches include the improvement of the conditions for sustainably operating farms, "fair" prices for their products, the elimination of environmentally incompatible subsidies, the expansion of nature protection contracts, a significant expansion of ecological farming, as well as re-orientation of training and consulting. The crucial factor is sustainable food consumption attitudes at the consumer end, i.e. an increased demand for food from sustainable, environmentally compatible and humane production, as well as an increased demand for regional and seasonal products and reduced consumption of animal products.

Mobility: Under the conditions of the status-quo scenario, the requirements for sustainable mobility cannot be met with by the year 2030. Vehicle numbers and the volume of traffic will increase, and together with this, the dependency on road traffic. Traffic-related emissions of air pollutants will decline considerably in some areas despite the expected development in traffic, because foreseeable enhancements in the purification of exhaust gas will lead to significant progress. At the same time, the proposed environmental action target will only be achieved for hydrocarbons, but not for other air pollutants. Above all, CO_2 emissions in 2030 will be considerably higher than today's level. This means that traffic will fail to make a reasonable contribution to climate protection. The noise burden caused by traffic will increase further despite technical improvements. No turnaround is expected for the trend in land use and transport, and communication zones will continue to grow almost without restraint.

If dramatic improvements in efficiency are assumed – for example, with regard to reducing specific CO_2 emissions or car tyre noise – then specific environmental burdens caused by traffic can be reduced significantly. Under these conditions, CO_2 emissions from all traffic will drop from 181 million tons in 1990 to 141 million tons in 2030, i.e. by 22 %. Emissions of nitrogen oxides (NO_x) fall significantly below the level of the trend scenario and reach the reduction target in the year 2030. In the case of particle emissions, these will fall by 94 % compared to 1990 and hence remain above the long-term reduction target of 99 %. Improving technical efficiency alone is hence not enough in order to achieve sustainable traffic development by 2030 with a view to all air pollutants and climate gases.

The sustainability scenario examines the extent to which sustainable mobility can be reached when, in addition to improvements in efficiency, traffic is also avoided (e.g. through shorter distances), shifted to more environmentally compatible forms of transport and optimized through a more efficient utilization of transport capacities. If the volume of traffic up to the year 2030 is reduced to the 2000 level and if the utilization of all means of traffic is improved by an average of 20 % compared to today, then traffic-related CO_2 emissions will fall to 50 % of the 1990 level, whilst air pollutant emissions will decline by between 93 and 96 %. The separating and fragmentation impacts of traffic will be significantly alleviated.

Tourism: Tourism is one of the largest industries world-wide. It has been recording substantial growth rates for 50 years. The German tourism industry generates around 8 % of gross domestic product and ranks among those industries with the greatest revenue.

Although tourism is essentially dependent on an intact environment, it contributes strongly towards the destruction of its natural foundations. The hazards which the land demand for tourism causes to biological diversity are particularly being in coastal regions and in the Alps. This is aggravated further by the logistical problems of drinking-water supply and waste disposal, as well as the concentration of wastes in terms of space and time.

The status-quo scenario assumes a 20 % growth of domestic tourism and a 60 % growth of international tourism by the year 2030 compared to 1999. Cross-border air traffic leads to a 60 % increase in CO_2 emissions. Since the environmental targets for land use and biodiversity are not achieved either, the tourism industry at the status-quo level still has a long way to go towards sustainable development.

The efficiency scenario assumes a substantial reduction of CO_2 emissions for domestic travel as a result of technical improvement, for example, due to more efficient means of transport, as well as energy-saving measures in the hotel industry. Although tourism-related emissions can be reduced by 40 % over the next 30 years, the growth rates in the long-distance travel market are likely to clearly over-compensate the emission reductions in domestic tourism. All in all, tourism-related CO_2 emissions will continue to increase. Furthermore, technical enhancements do not lead to any significant improvements in energy and land consumption or in biodiversity loss.

The sustainability scenario requires CO_2 emission reductions beyond what is possible with technical measures whilst giving greater consideration to biodiversity losses resulting from the use of land for tourism. As a result of the choice of travel destinations and means of transport, and as a result of nature conservation and land management and ecologically orientated accommodation, foreign travel will record a significantly lower increase of 34 % than in the case of the other two scenarios with 57 % in each case. Domestic travel, in contrast, will record a significantly greater increase of 32 %.

This leads to a considerably improved environmental balance for tourism, in particular, thanks to reduced air travel volumes. CO_2 emissions due to tourism in Germany is reduced by half compared to 1999, with CO_2 emissions from cross-border air travel being reduced by 45 %. The present trend "more often and further for shorter" is reversed. In the case of land consumption and biodiversity, too, significant improvements can be expected compared to the other two scenarios.

Designing a policy of sustainability: In the last chapter, the authors provide a broader analysis, presenting different types of instruments with a view to their various incentives for the sustainable use of the natural foundations of life. These instruments include:

- Regulatory instruments (approval obligations, limit values and environmental impact assessment)
- Planning instruments (urban land use planning and environmental assessment of plans and programmes)
- Economic instruments as environment-related taxes and tradable environmental licenses)
- Other tools for strengthening individual responsibility (self-commitments, instruments of integrated product policy, education)

Although certain types of instruments are particularly suitable for specific fields of action, there is no universal, superior instrument that is equally applicable to all the fields of action. The effectiveness of the instruments must always be evaluated in light of the given situation, the relevant environmental protection aims and targets, as well as the social conditions.

The study suggests that sustainable environmentally compatible development is possible without overchallenging society as a whole or without exacting an unreasonable toll from individuals. However, such a development is only possible when in conjunction with improved energy and material efficiency, public attitudes and behaviour also change. These mental changes do not, however, necessarily lead to sourpuss abstention. Orientation towards the concept of sustainable development is certainly compatible with a free society and considerably high consumption levels; it increases rather than restricts possibilities for an active and self-determined life. Changed rather than restricted living and consumption styles are what matters. *(I 1.1)*

Sustainable communal development and Local Agenda 21

Within the scope of the German preparations for the World Summit on Sustainable Development in Johannesburg, the UBA commissioned the International Council for Local Environmental Initiatives (ICLEI), Freiburg, and the German Institute of Urban Affairs (Difu), Berlin, to draft an up-to-date status and prospects report on "Communal sustainability policy and Local Agenda 21 in Germany. At the initiative of the Federal Ministry for the Environment (BMU), the German Conference of the Ministers of the Environment (UMK) at its 57th meeting on 29 and 30 November 2001 in Bremen adopted the report as part of a declaration on the Local Agenda 21 ("Bremen document on the Local Agenda 21") that was jointly drafted with central municipal organizations.

The aim is to recruit the maximum number of further municipalities possible to participate in the Agenda 21 process whilst at the same time underlining the specific contributions, challenges and options of cities and municipalities with their importance for a pioneering national sustainability strategy which covers all levels of the German federal system. According to the Bonn-based Agenda-Transfer agency, in 2001, 2,052 municipalities in Germany were prepared to draft a Local Agenda 21.

The study "Kommunale Nachhaltigkeitspolitik und Lokale Agenda 21" [Communal sustainability policy and Local Agenda 21"] [4] provides an overview of the general conditions, activities, successes, obstacles and prospects of German municipalities on their way towards sustainable development within the scope of the Local Agenda 21. It addresses both cross-section orientated aspects (such as the legal framework for municipalities) and several sectoral aspects of communal action (such as climate protection/energy, land use). Some of the results of the study are listed here.

- The German system of communal self-administration and the pertinent principle of self-responsibility offer a suitable framework for communal sustainability policy.
- Sustainability strategies at a local level can draw on the experience of German municipalities and their use of formal and informal planning instruments and procedures (such as urban land use planning). In order to improve dialogue and consensus among the various actors, the Local Agenda en-

ables and supports the exchange of information, planning and definition of contents, as well as public acceptance and citizens' involvement.
- In view of growing competition among municipalities as industrial sites, the involvement of companies in the Agenda 21 process is a crucial factor for success. Aims and measures must be defined which are jointly supported by communal administrations and business.

Both this study and the "Bremen declaration" show that the Local Agenda 21 offers the unique opportunity to set new trends for future-orientated development in municipalities, as well as to remember and reconsider the values of our society. The Agenda process harmonizes various political fields more closely with each other, permitting participation by both citizens keen to take part, as well as by groups from society. It employs concrete targets and indicators which make steps towards sustainability measurable and understandable. *(I 2.3)*

Cities on their way towards sustainable mobility

Transport and mobility belong to the most difficult fields of action in communal planning. Like hardly any other communal area, transport and mobility involve both ecological as well as economic and social issues. Difficulties are often encountered even before or during the planning process. One important reason for this is the lack of sustainability targets and indicators. There is no reliable orientation framework for political and planning decisions.

In order to overcome this shortcoming, the UBA launched a research project in 1999 titled "Kommunale Agenda 21 – Dauerhaft umweltverträgliche Mobilität in Stadt und Region" [Municipal Agenda 21 – model project: permanently environmentally compatible mobility in cities and regions]. The aim was to develop quantified quality targets and indicators for sustainable mobility which subsequently underwent practical testing in model cities. On conclusion of sub-project 1, the work group of BPI-Consult, Berlin, and PRR, Aachen, submitted a comprehensive catalogue of sustainability targets and indicators for the communal mobility and transport sector, also integrating areas of indirect relevance for the environment, such as urban development or settlement structures. [5]

The second sub-project "Man – city – transport – environment" launched in 2001 is the practical application of the catalogue of targets and indicators in the three model cities of Erfurt, Görlitz and Lörrach. One central task involves developing concrete action targets and measures for the individual cities from the general catalogue of environmental targets specifically adapted to their local conditions and possibilities. This sub-project is managed by the planning firm BSV, Aachen. In a parallel project, the city of Herdecke is testing the proposed quality targets and indicators in its own responsibility within the scope of its traffic development plan. *(I 3.1)*

Sustainable water supply

Compared to the other fields of action for sustainable development, the water supply situation is different and has its own particular features. The first priority is the safe supply of quality drinking water in the interest of human health, whilst the second priority is the close link between drinking-water supplies as a utility service and environmental protection. Since there are no or only limited alternatives to public water supply, any misguided developments have a direct impact on citizens and their everyday lives. Another special feature is the very high quality level of water supply in Germany in terms of both product quality and its contribution towards environmental protection. This means that a good share of sustainable development has already been achieved.

Germany's water supply sector is, however, currently undergoing a phase of change. An intensive debate is currently focused on how the future water supply system will look. This has consequences for the policy of companies: Ways to cut costs are being sought, organization structures are changing, co-operations are being launched and mergers are taking place. Furthermore, the water supply sector is subject to a number of external influences – budget restrictions on the part of municipalities, deregulation of other infrastructure areas, and the advent of large **MULTI-UTILITY COMPANIES.** These trends will lead to greater concentration in industry and a higher share of privately owned companies in the water supply sector.

It is now important to maintain and develop the present standard further under changing framework conditions. Former successes are largely owed to the fact

that these tasks have so far been handled by municipal companies under the supervision of cities and municipalities. However, there is no guarantee that this will last forever – ever-increasing economic restrictions on communal budgets often dictate very short-term decisions which have adverse effects that will only be felt in the future. This equally concerns private-sector and public-sector companies.

Multi-Utility Companies: *This term refers to companies offering a host of services (such as water supply, sewage disposal, district heating, gas, telecommunications, data communication, facility management).*

Water supply is thus faced with the particular challenge of reconciling the short-term time horizon of commercial decisions with the long-term perspective of sustainable development. In 2001, the UBA drafted a report that describes the aims and measures of sustainable water supply in greater detail [6].

The water supply sector is largely characterized as a natural monopoly where competition is difficult in many respects, including economic, hygienic and ecological aspects. The water law must be revised to reflect the new challenges in order to ensure efficient and sustainable services which also reflect the interests of environmental and health protection. In view of the regional nature of water as a resource and the constitutional distribution of responsibilities between federal government, federal states and municipalities, the municipalities are the ideal steering and control level when it comes to the efficient implementation of the aims of sustainable development. This will, however, require improved and more influential communal steering and control functions in order to strengthen the "competition of systems" for which Germany is famous at an international level and to improve its efficiency.

It is assumed that the government will have to accompany the development even in the – foreseeable – case where the deregulation approach, i.e. the elimination of regional monopolies for drinking-water supply, is not pursued further for water supply companies because the economic conditions for communal and private companies will be changing anyway. The UBA hence suggests several measures in order to promote sustainable water supply in Germany:

- The inclusion of the targets of sustainable water supply (in particular, of local supplies), in the *Federal Water Act* (WHG)
- Improved protection of ground water resources, in particular, through measures in the field of agricultural policy
- The introduction of a nation-wide, transparent performance comparison for the water supply sector including economic, hygienic and ecological parameters in order to simplify the steering, supervisory and control functions of municipalities and public involvement and in order to create incentives for sustainable water supply. *(II 3.1)*

Environmental quality targets and indicators for environmental policy

The concept of sustainable development is orientated not just towards economic and social development, but, first and foremost, towards the limited availability of natural resources and the limited resilience of the natural environment. **ENVIRONMENTAL QUALITY TARGETS** and **ENVIRONMENTAL ACTION GOALS** can make these long-term ecological restrictions visible. Environmental indicators also play an important communication function in the sustainability debate. Thanks to environmental indicators, even rather qualitative targets can be measured and hence checked. Furthermore, the public debate can be focused on specific issues and cornerstones of environmental policy, and developments which are considered necessary for the forthcoming years can be made transparent. As a precondition for this, indicators must be understandable and defined in accordance with technical requirements. Furthermore, they must be put into a context of values which correlates observations and development trends with the targeted environmental qualities.

The environmental quality and action goals as well as the related indicators of the national sustainability strategy are examples of this concept. One environmental action goal, for example, provides that the land consumption for settlement and transport be limited to a maximum of 30 hectares per day in 2020. The indicator for this is the development of settlement and transport areas which is surveyed on an annual basis.

Other general goals of environmental policy are yet to be defined in detail. This applies, for example, to the

international protection goal of the Rio Framework Convention on Climate Change (refer to chapter 5) whereby "dangerous anthropogenic interference in the climate system" must be prevented – in view of the second and further commitment periods of the Kyoto Protocol. The UBA has commissioned a research project on this issue.

In 2000, the UBA published a current summary of the political and technical debate on environmental quality goals focusing on methodological approaches. [7]

The UBA focuses on an action-based approach for developing environmental goals and indicators. One difficulty in this context, however, is the increasing occurrence of environmental problems and phenomena which must be considered as long-term effects. In these cases, in particular, monocausal analyses fail to explore and explain the underlying cause-and-effect relations and load paths. Examples include the greenhouse effect, hormonal effects of substances in the environment, exposure of ecosystems to high immission levels, as well as the threats facing biological diversity. One particular challenge is the often trans-media and increasingly globally networked nature of environmental burdens.

The trans-media analysis of environmental problems to be aimed at, as well as the definition of environmental quality goals against the background of trans-media processes can help prevent any shifting of environmental burdens – for example, from soils to waters – from being overlooked.

The activities for the implementation of the Alpine Convention described below illustrate the importance of environmental quality goals and environmental indicators even in international environmental policy.

The Alpine Convention – shaping a systematic discussion on targets and indicators

The *Alpine Convention* provides that a policy for sustainable, i.e. lasting, environmentally compatible development in the Alpine region should be supported by citizens rather than being imposed by the government, and should be respected and adhered to by tourists in the Alps. Regional public institutions, in particular, should be supported when it comes to the practical implementation of the Convention's goals. One goal in this context, for example, is the reconciliation of tourism and leisure activities with ecological and social requirements.

An international work group – chaired by the UBA – was set up to address specific environmental quality goals for Alpine regions in order to further the implementation of the Alpine Convention and its protocols in line with these principles. This was triggered by the debate on the *Transport Protocol* and its Article 16 which obliges the contracting parties to define and implement environmental quality goals, standards and indicators which are adapted to the specific conditions of the Alpine region.

The work group's central aim is to compile existing goals and to make these available to decision-makers with a view to the implementation of the Alpine Convention and its protocols.

In order to enable a systematic discussion of goals for the "transport" and "mountain forest" areas, the current knowledge of the interaction of actions was summarized on the basis of an ecosystem-related analysis of the current condition of the Alpine environment which, for its part, was based on various aspects, including the results of ecosystem research. The system model chosen to represent these interactions corresponds to the international approaches

Environmental quality goals: *Environmental quality goals characterize a desirable condition of the environment. They combine scientific knowledge with assessments of resources and protection levels. Environmental quality goals are determined for man and/or the environment on an object-related or medium-related basis. They are orientated towards regeneration rates for important resources or towards ecological tolerance limits or towards the protection of human health and the needs of today's and future generations.*

Environmental action goals: *An environmental action goal describes the total reduction required in emissions as the difference between a currently existing exposure and the maximum permissible exposure (concentration in the environmental medium). The environmental action goal indicates which total reduction of emissions into the environment is necessary in order to achieve an environmental quality goal.*

for the indicator discussion. A strongly simplified rendering of the complex cause-and-effect interactions was adopted for pragmatic reasons.

The work group provided a systematic array of correlations between existing national environmental quality goals, goals laid down in the Alpine Convention and its protocols, as well as other, internationally valid goals concerning existing factors of action, such as eutrophication (excessive accumulation of nutrients) and acidification of soils which were differentiated further with a view to the special ecological status of the Alpine region. Less concrete national aims are in part defined further by the technical goals of the Alpine Convention and its protocols or even support their implementation. This applies, for example, to the goals for future traffic development in the Alpine region. [7a]

The work has shown that – notwithstanding the large number of environmental quality goals which are already contained in the Alpine Convention and its protocols – there is still a significant lack of measures that could enable a more concrete definition of goals in the form of indicators and standards. First proposals were made in order to identify such indicators. Both the political implementation of the goals and the verification of their ecological efficiency are directly dependent on these measures. *(II 1.1)*

[1a] Nationale Strategie für eine nachhaltige Entwicklung [National strategy for sustainable development] – Resolution by the federal government of 17 April 2002 (Bundestags-Drucksache 14/8953). Refer also on the Internet to www.dialog-nachhaltigkeit.de

[2] "Nachhaltiges Deutschland – Wege zu einer dauerhaft umweltgerechten Entwicklung" [Sustainable Germany – Ways Towards Long-term Environmental Development], Erich Schmidt Verlag, Berlin, 1997, available at bookstores.

[3] "Nachhaltiges Deutschland – Wege zu einer dauerhaft umweltgerechten Entwicklung" [Sustainable Germany – Ways Towards Long-term Environmental Development], Erich Schmidt Verlag, Berlin, 2002, available at bookstores.

[4] The report and the declaration were published in the "Umweltpolitik" series of the Federal Ministry for the Environment. Free copies are available from the Federal Ministry for the Environment; Public Relations Department, 11055 Berlin, Fax (Germany) 01888/305-2044.

[5] The final report "Kommunale Agenda 21 – Ziele und Indikatoren einer nachhaltigen Mobilität" [Communal Agenda 21 – Aims and Indicators of Sustainable Mobility] will be published in the BERICHTE series by Erich Schmidt Verlag, Berlin, and will be available at bookstores.

[6] "Nachhaltige Wasserversorgung in Deutschland" [Sustainable Water Supply] is published by Erich Schmidt Verlag, Berlin, (ISBN 3-503-06607-1).

[7] Free copies of "Ziele für die Umweltqualität" [Goals for Environmental Quality] are available from the UBA's Central Services Unit (address: see page 2). The summary is also available as a PDF file on the Internet at www.umweltbundesamt.de.

The report "Umweltqualitätsziele für die Alpen" [Environmental Quality Goals for the Alps] is available at www.jahr-der-berge.de.

2. Sustainability and environmental communication

Overview

- Introduction
- Integrating the concept of sustainability into environmental communication
- Gender relationships and sustainability
- Arts, culture and sustainability
- Promoting associations and societies
- Information and advisory offers concerning the Local Agenda 21

Introduction

Since 1992, the concept of sustainable development has become a firmly established part of environmental policy world-wide. This was triggered by the 1992 United Nations Conference on Development and the Environment in Rio de Janeiro (refer to chapter 1). The principle of prevention is thus not restricted to environmental policy in the stricter sense, but applies to man's actions in general and to economic and social development in particular which must be subject to the general requirements of ecological compatibility. A comprehensive programme must be developed for social and cultural re-orientation.

In this respect, the concept of sustainability is also placing considerable demands on wider environmental communication which addresses more people. Environmental communication itself is becoming an important tool of environmental policy because large sections of the population and groups of society must be activated and involved in communication, planning and decision-making processes for sustainable prospects. New communication forms and strategies are required that extend far beyond the communication or knowledge of problems or isolated proposals for action.

Oddly enough, the "sustainability" concept which includes the promotion of communication and discourse has failed to be widely accepted by the general public up to now.

According to regular representative polls carried out by the UBA, it has not been possible up to now to even make the term itself sufficiently known: Just 10 to 15 % of those polled stated that they had ever heard it. What the term "sustainability" apparently needs in order to become a real concept is its cultural integration into the life of the modern industrial society, into everyday communication between citizens.

Integrating the concept of sustainability into environmental communication

One approach to tackle this issue was the research project "Integrating the concept of sustainability into environmental communications" designed by the UBA and carried out by Gesellschaft für sozioökonomische Forschung in Potsdam (Figure 1). Eleven concepts developed by sociologists are presented in this study, addressing the issue of how to communicate sustainability and its preconditions.

New approaches in the debate on ethics and the environment, for example, develop principles for ecological living, underline the importance of "subjectively perceived fairness" in conjunction with the acceptance of restrictive political measures in the interest of the environment, and analyse the consequences for environmental communication resulting from the correlations between sustainability and gender issues.

New approaches for participation-orientated environmental communication that aim to develop a new culture of discourse and co-operation. These approaches address, for example, the question as to how the communication of sustainability-orientated innovation can be improved and how co-operation between different actors (business, scientists, consumers) can be boosted.

New approaches for environmental education address issues of action-orientated learning, reflection and communication options in educational projects. One example is the model trial of the joint commission of federal government and federal state government for education planning and research promotion (BLK) which prepares the integration of "education for sustainable development" into the regular curriculum.

The researchers conclude that the "popularisation" of sustainable contents and goals must do more than just make the term "sustainability" generally known. Instead, a methodologically diversified approach is needed in order to develop some kind of communicative sub-structure from where the concept of sustainability is disseminated into all public discourse until it becomes firmly established there. The concepts proposed have made it clear that social sciences can definitely contribute towards this goal. This will, however, require a significant expansion of sociological environmental research, as well as a stronger focus by policymakers on a renewal of environmental communication.

The results of the project were published in 2001 [8].
(I 2.2)

Gender relationships and sustainable development

Like social equality in general, gender equality is also an integral part of the concept of sustainability. When communicating sustainable development, one has to consider that:

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

Communicating sustainable development perspectives within the context of gender mainstreaming can open up new issues relevant for everyday life for the public debate on the concept of sustainability. The joint responsibility of women and men for those aspects of life and policy requiring sustainability – such as health, mobility, living and working environments, education, consumption, leisure, production and reproduction – is one of the issues in this context.

The project "Genders and sustainable development" [9] launched by the UBA in 2001 addresses these gender-related aspects that have been neglected up to now by environmental researchers and policymakers. The project proposes measures and instruments suitable for ensuring that these aspects will be adequately considered in future UBA projects. One example is the development of some kind of "gender mainstreaming compatibility test", i.e. a **GENDER IMPACT ASSESSMENT**, in conjunction with a project underway at the Federal Ministry for the Environment (BMU). This instrument is to form an integral part of the UBA's work in the medium term.

Gender Impact Assessment: *This term refers to an instrument that can be used to analyse the impact of measures – such as laws and programmes – on women and men and to assess this impact from a gender mainstreaming point of view.*

From June 2001 to January 2002, an interdisciplinary team of researchers at Lüneburg university organised a series of six workshops within the scope of the Environmental Research Plan (UFOPLAN). These workshops were designed as a forum for communication and discussion of the project subject with fellow scientists at the UBA. Experts reported on the state of the art and discussion in areas concerning both gender research and sustainability. Issues relevant for sustainability – such as "Living – working – consuming", "Using products – designing products – evaluating substances", "Moving – finding one's place" or "Ecology of time" [10] were at the heart of these events. In the "Products and consumption" area, for example, the workshop series showed that women have a different way of using products and services, and that their evaluation of health and environmental risks differs from that of men. Notwithstanding this, women play a much lesser role in the manufacture and development of products. It became clear that the data basis currently available and which so far hardly addresses any differences between the genders must be substantially amended.

A congress will be held in 2002 which will serve as a forum for a broader discussion between experts from research, administrations, political bodies and non-governmental organizations (NGOs). The event will be linked to a "Market of options" where gender-specific sustainability projects of all kinds will be presented and networking communicated.

What's more, the UBA project also tests new, dialogue-orientated forms of working. The project group's experience with project organization, team development, supervision, self-evaluation and principles of the "learning organization" is also to give new impetus to the modernization process launched at the Agency.

Arts, culture and sustainability

Sustainable development with its ambitious requirement to examine and, when necessary, to put into perspective or even to revise previous standards, values and procedures in all areas of society is also a tremendous cultural challenge. Whilst documents and the debate on sustainability completely lacked any cultural dimension, arts and culture are now becoming increasingly important in the sustainability discussion in academic circles, among Agenda actors (for more details of Agenda 21, please refer to chapter 1), as well as among ecologically orientated associations and information media [11] [12] [13].

The medium to long-term challenge will be to involve culture policymakers, culture event organizers and artists in Agenda processes and to initiate creative co-operation projects. Artists can make ideas, visions and existential experiences come to life in universally understood languages, in symbols, rites, understandable icons and images. This is a very valuable asset in the context of sustainability communication.

The UBA's tradition of presenting environment-orientated artists on its premises and to enter into dialogue with them attains a new meaning in this context.

In 2001, the Agency continued this tradition with four art exhibitions at its headquarters at Bismarckplatz: "Stadträume" (Urban Spaces) by Dietrich Klakow, "Osmose" (Figure 2) with six artists from Berlin, "Schiffe versenken" (Sinking Ships) of the Broschwitz group, and "Pflanzenmensch" (Plant Man) by Ren Rong. Furthermore, Beate Treptow presented her exhibition "Wie Wind entsteht" (How Wind Is Generated) at the Westerland air quality measuring station on the island of Sylt. The library showed six smaller, thematic art exhibitions, together with the presentation of treasures from its stock of books.

Dietrich Klakow, for example, showed metal miniatures of buildings and streets as ironical and critical comments on Berlin's building history and urban aesthetics over recent years. His "Urban Model" made up of individual, pointed sculptures is a genuine, artistic treatment of much-discussed aspects of the urban environment – such as quality of life and living, traffic problems, monotony, distorted proportions and planning errors. In this sense, Klakow's critical works can also be seen as a signpost pointing the way towards features which the quality of urban planning orientated towards sustainability should possess.

Ren Rong, a Chinese artist who now lives near Bonn, presented his "Plant Men" at the UBA – lively, bisexual hybrid beings with floral and human shapes. Cut out of paper and metal, they are the artist's main motif which he creates in an inexhaustible range of variations. The flow of images on the long exhibition wall radiated meditative rest. Sensuality, love of life, eroticism and the charm of the figures refer to new ways of perceiving nature and of man's self-perception which are important in the context of sustainable lifestyles (Figure 3).

The "Ökologische Diskurse" (Ecological Discourse) series of events which took place in 2001 in Berlin under the motto "Water and Power" also included el-

Figure 2: "Osmose" (Osmosis), an installation by Ping Qiu

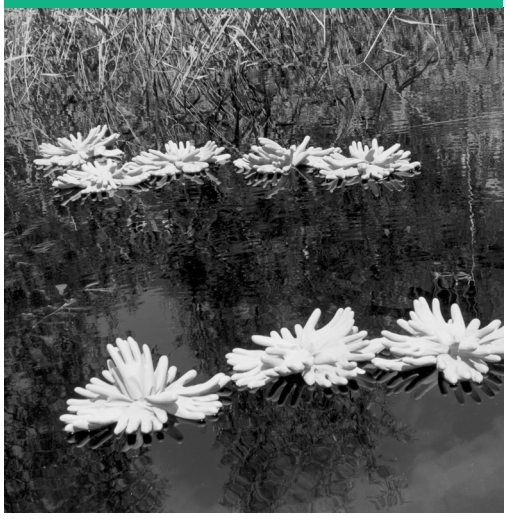


Figure 3: "Pflanzenmensch" (Plant Man) by Ren Rong

ements of artistic work. On ten evenings, experts from the fields of science, business, environmental policy, practical environmental protection and art discussed with the audience the risks, mastering, shaping and use of water as a vital element of life. This discourse was closely linked to an artistic project by action artist Ernesto Handl and his Story Dealer team who developed a series of water images with all the participants as an artistic expression of what the discussions had shown.

The highlight and a lasting experience was the final "Floating Exhibition" of the pictures in November 2001 on the overflow arm of the Landwehrkanal, a canal in front of the Schlesisches Tor underground station (Figure 4).

Accompanied by flute music and literary and philosophical texts about the elixir water, forty expressive watercolour paintings on torch-illuminated rafts floated past the visitors.

With experimental events like this, the UBA will continue testing new communication offers related to sustainability issues.

Promoting associations and societies

For decades now, environmental activities and initiatives by associations, environmental societies and other NGOs have had a strong impact on the development of public environmental awareness in Germany.

Their involvement in the Agenda 21 process, as well as related information, education and support offers by associations and societies are very important for the communication of sustainability.

In 2001, the UBA sponsored 28 nation-wide environmental associations plus another 14 organizations with a financial volume of around EUR 2.5 million on behalf of the Federal Ministry for the Environment. A total of 60 projects were supported, a major part of them dealing with communication and the gradual implementation of sustainability goals.

The "Arbeitsgemeinschaft Natur- und Umweltbildung (ANU)" (Working group on nature and environmental education), for example, received subsidies for its project "Qualification of environment centres with regard to Agenda 21". This project offers further education for staff at environmental and nature conservation centres in order to support local Agenda activities and to offer further education programmes in this context. The ANU offers best-practice examples from environment centres on a regular basis and supports the networking of centres as well as their contacts with multipliers and the media.

Various projects by associations and societies are supported and subsidized by the UBA in order to motivate and involved children and youths in the aims of securing a sustainable future. The BUNDjugend association has proclaimed an annual "children's environmental day" at schools, kindergartens and in the general public where children, parents and teachers

create projects, thereby demonstrating and practicing their commitment to a selected environmental subject. In 2001, some 75,000 young energy experts actively worked for the children's environmental day under the motto "energy detectives". "Dumb tins eat energy" was the title of the central event held at Berlin's Alexanderplatz square. Children disguised as tin monsters and tin devils showed self-made posters in order to demonstrate ways to save energy in a performance that met with extensive media coverage.

The "Bundesverband für Umweltberatung (bfub)" (Federal Association for Environmental Consulting) advocates new, sustainable consumption models and products. Last year, the association published and organized information material, exhibitions and Internet modules on environmentally and socially compatible products, as well as a consultancy package on "Ecological Building and Rehabilitation". The UBA supported these campaigns, as well as the development of the "Slow Food" magazine by the German slow-food movement. This international society is dedicated to cultivating the pleasure of eating and drinking, along with ecologically and regionally orientated food production. Slow Food's activities demonstrate to a growing number of gourmets and connoisseurs that a sustainable lifestyle can enhance life rather than demanding a sacrifice. *(I 1.3)*

Information and advisory offers concerning the Local Agenda 21

Sustainable development must be implemented, first and foremost, at a local level, i.e. in our cities, municipalities and districts. Co-operation between municipalities, citizens, public communities and business is hence a major precondition for the implementation of the "sustainability" concept.

The UBA has already developed a host of "modules" in order to support municipalities in the development and implementation of a Local Agenda 21. These include, for example:

- The "Lokale Agenda 21" manual
- The literature and address directory
- The "Berlin-Köpenick" study and
- The study titled "Local Agenda 21 – a European Comparison" [14].

Furthermore, concise information is provided on important activities by the federal government with a reference to the Local Agenda 21 (project results, explanations, papers, reports on the state of affairs). Apart from this, the Federal Environmental Agency also publishes guidelines and advice manuals in order to support sector-related fields of action related to sustainable communal development ("Umweltschutz in der Flächennutzungsplanung" (Environmental protection in land use planning). A status and prospective report titled "Kommunale Nachhaltigkeitspolitik und Lokale Agenda 21" (Communal sustainability police and Local Agenda 21) (refer to chapter 1) was published at the end of 2001 on the occasion of the national preparations for the World Summit on Sustainable Development in Johannesburg in August/ September 2002. The UBA will continue to offer suitable information and advisory services in order to address the "Local Agenda 21". *(I 2.3)*

[8] The study "Die Verankerung des Nachhaltigkeitssleitbildes" (Integrating the sustainability concept) (BERICHTE 4/01) was published by Erich Schmidt Verlag, Berlin, and is available at bookstores (ISBN 3-503-06602-0).

[9] Available on the Internet at www.umweltbundesamt.de.

[10] The documentation "Geschlechterverhältnisse und Nachhaltigkeit" [Gender relationships and sustainability] will be published in UBA's BERICHTE series by Erich Schmidt Verlag, Berlin, and will be available through bookstores.

[11] Available on the Internet at www.kupoge.de/ifk/tutzinger-manifest

[12] Lebenskunst. Auf den Spuren einer Ästhetik der Nachhaltigkeit (The art of living. Towards aesthetics of sustainability.) Zeitschrift Politische Ökologie No. 69, April 2001, available from Deutsche Gesellschaft für Umwelterziehung, Ulmenstr. 10, 22299 Hamburg, telephone (Germany) 040/4 10 96 21

[13] Berliner Briefe der Lokalen Agenda 21 Berlin, (Berlin letters of Local Agenda 21 Berlin) No. 43, December 2001, available from Grüne Liga Berlin, Prenzlauer Allee 230, 10405 Berlin, telephone (Germany): 030/44 33 91-64.

[14] This brochure, as well as further brochures and materials on the Local Agenda 21, are available from the UBA, Central Services Unit (address on page 2). Information on the Local Agenda 21 is also available on the Internet at www.umweltbundesamt.de/rup. A host of information is available for downloading.

3. Substances and flows of goods: genetic engineering

Overview

- Introduction
- The EU Directive on the Deliberate Release of Genetically Modified Organisms: what's new?
- Improvements in consumer protection
- Monitoring of genetically modified organisms (GMOs)
- Avoiding pollution – a matter of credibility

Introduction

For several years now, no new approval has been granted in the EU for placing genetically modified organisms on the market. One of the reasons for this is the fact that many member states do not consider environmental and consumer protection to be sufficiently ensured on the basis of the *EEC Directive on the Deliberate Release of GMOs, 90/220/EEC*. The revised EU Directive on the Deliberate Release of Genetically Modified Organisms came into effect in April 2001 as directive *2001/18/EEC*. Additional draft regulations for labelling and traceability, as well as for genetically modified foodstuffs and animal food exist. The German federal government will implement the EU Directive on the Deliberate Release of GMOs – which must be completed by 17 October 2002 – separate from the implementation of the equally revised *EU System Directive (directive 98/81/EEC)* which is currently underway.

Guaranteeing the personal freedom of choice on the part of consumers is as important as the exclusion of health and environmental risks resulting from green genetic engineering. This means that ways must be found that permit the co-existence of farms that are run without genetic engineering on the one hand as well as farms that use genetic engineering on the other. The only way to ensure this is to keep the flows of goods separate, from agricultural production via transport to processing. Limit values must be adopted in order to restrict unintended impurities. Furthermore, additional measures are necessary to minimize such risks in certain areas, such as ecological farming, for example, in the form of distance requirements in order to prevent the spreading of pollen.

This must be achieved not just by legislative measures, but also through initiatives and self-commitments on the part of farmers' associations, processors and restaurants in order to ensure quality "without genetic engineering". These measures can also lead to competitive advantages.

The EU Directive on the Deliberate Release of Genetically Modified Organisms: what's new?

One of the most important new features of the revised *EU Directive on the Deliberate Release of Genetically Modified Organisms* is the introduction of a case-specific and general monitoring system for genetically modified organisms approved for sale on the market. This monitoring system is also expected to enable the early identification of unexpected adverse effects on the environment, so that remedial measures can be taken, when necessary. The Federal Environmental Agency (UBA) is currently co-operating with the work group of federal and state governments on "Monitoring the environmental effects of genetically modified plants" in order to develop a concept for the necessary legislation.

Another new feature: Future licenses for the placing on the market of products containing or consisting of GMOs will be limited to a term of ten years. Renewal will be possible, but must be applied for. Previous licenses were issued for an indefinite term. The limitation of the term makes it easier to keep track of the product on the market: The results of the monitoring process, for example, can be considered when it comes to the question as to whether or not a license is to be renewed.

For the first time ever, the EU Directive on the Deliberate Release of GMOs now also foresees risk assessment principles. Direct, indirect, immediate or delayed harmful effects of GMOs on human health and the environment are to be identified and evaluated. Compared to the previous directive, this revised version improves the safety level because it is now also possible to consider indirect effects in the assessment, for example, when farming practices change. The general principles laid down in the directive require further definition in detail. The UBA has hence commissioned the university of Bremen with a research project titled "Fortschreibung des Konzeptes zur Bewertung von Risiken bei Freisetzungen und dem Inverkehrbringen von gentechnisch veränderten Organismen" (Updating the risk assessment concept related to the release and placing on the market of genetically modified organisms).

Another new feature of the EU Directive on the Deliberate Release of GMOs is the possibility to amend licenses for placing GMOs on the market by adding certain conditions for the protection of special ecosystems, such as biosphere reserves, nature conservation or so-called flora-fauna habitat areas. Furthermore, the license can include specific conditions, such as distance requirements or restrictions on cultivation.

In order to protect human and animal life, it was also decided not to use any antibiotic resistance genes in GMOs as a precautionary and preventive measure. The use of genes that lead to a resistance to antibiotics used in human and veterinary medicine will be prohibited as of 2005 for GMOs to be placed on the market and as of 2009 for GMOs to be released within the scope of experiments.

The revised directive significantly increased the transparency of the licensing procedure. Information concerning the genetically modified organisms must be publicly disclosed, for example, even for organisms where an application was rejected. Furthermore, the general public must be informed about risk assessments, as well as release and cultivation locations (public cultivation register).

Improvements in consumer protection

Two draft regulations by the EU Commission are particularly important for consumers: the *EU Directive on the Traceability and Labelling of GMOs as well as on the Revision of Directive 2001/18/EEC (COM [2001] 182 final)* and the *EU Directive on Genetically Modified Food and Animal Food (COM [2001] 425 final)* which are designed to supplement the new EU Directive on the Deliberate Release of GMOs. In summer 2001, the Commission put up the two drafts for public discussion.

The intention is to ensure the traceability of both GMOs as products or in products, including seeds, and of foodstuffs and animal food produced from GMOs throughout the entire production and distribution chain (from the producer to the consumer). It is expected that this will facilitate the targeted monitoring of possible effects on the environment and human health, so that products can be taken off the market when previously unforeseen risks arise.

Traceability is ensured by imposing an obligation on companies to provide every downstream party in the value chain with information concerning the specific identity of the product. The parties involved are obliged to keep this information available for a term of five years for possible investigations. Information systems must hence be established in order to enable a product to be traced from its origin throughout its subsequent uses. One possible concept for this is a registration code together with information about the GMO in question to be saved in a database. In order to enable a standardized procedure for checks and analyses and in order to ensure a reliable legal situation for the parties involved, the EU Commission is also planning to develop technical directives and guidelines for sampling and testing.

The *EU Directive on Genetically Modified Food and Animal Food* is to supersede the *EU Ordinance on Novel Foods (Ordinance EU 258/97/EU, "EU Novel-food Ordinance")* with a view to genetically modified foodstuffs, and will include genetically modified animal food for which no product-specific rules are so far available. The directive is also to cover food additives, flavours and animal food additives made of GMOs which are not yet covered by the EU Novel-food Ordinance.

The draft regulation covers food and animal food consisting of GMOs (such as tomatoes), containing GMOs (yoghurt) or produced from GMOs (tomato ketchup, soybean flour). In the current negotiations on the draft regulation, it is still not clear whether it will also cover foodstuffs and animal food which were produced using GMOs, but which no longer contain

these. Another open point is whether foodstuffs which contain meat, milk or eggs from animals that were fed with genetically modified food are to be subject to the proposed licensing process or whether such foodstuffs will have to be labelled.

Foodstuffs and animal food as well as products to be further processed containing a maximum share of 1 % of genetically modified substances or organisms will be exempt from the labelling obligation if such contamination is demonstrably accidental or technically unavoidable.

This 1 % threshold is still controversial. Many of the parties involved consider it to be too high, all the more so, since the contaminated share may well be increased during subsequent processing. Another matter to be clarified involves the arguments and data which applicants will have to submit in order to demonstrate that they have taken suitable measures in order to avoid or reduce GMO contamination. A definition of "accidental or technically unavoidable contamination" is hence urgently needed.

According to the draft regulation, the threshold for GMO-contaminated products will apply to licensed and non-licensed GMOs which have already been subjected to risk assessments at EU level. The detection limit will be applied to non-licensed GMOs for which no assessment has been carried out. A limit value for seeds is still under discussion. It is likely to be below 1 %.

In the interest of the principle of a single contact authority, one application should be sufficient to obtain the license for the deliberate release of GMOs into the environment pursuant to the criteria of the EU Directive on the Deliberate Release of GMOs *and* the approval to use such GMOs in foodstuffs or animal food in accordance with the criteria of the proposed EU Novel-food Ordinance. The environmental impact assessments and the tests for determining the hazard to human and animal health which are currently still carried out by the individual EU member states will then be centralised under the technical responsibility of the European Food Authority which is currently in the process of being established. Experts are, however, still discussing the question whether the European Food Authority will be able to adequately consider local and national environmental interests relevant for agricultural production within the scope of environmental impact assessments.

Monitoring of genetically modified organisms

Even licensed GMOs will in future be subject to controls in order to avoid negative consequences for man and the environment.

In recent years, the UBA has already worked intensively on a technical concept for a GMO monitoring system. In this context, the Umweltforschungszentrum Bremen was commissioned in 1999 with a research project on the "Development of a long-term monitoring concept for environmental impacts of transgenic culture plants". The research project compiles possible paths of action of GMOs and examines the parameters and methods that can be used and standardized for monitoring purposes.

As a supplementary effort, the UBA is pursuing a total of seven model projects for monitoring genetically modified plants in co-operation with federal states. The model projects are designed to examine and further develop GMO monitoring methods at a practical level,. Furthermore, they are intended to establish a basis for future cost-to-benefit assessments.

The UBA is responsible for the examination of environmental impacts and advocates the creation of a central co-ordination unit for GMO monitoring that was recommended by the German Council of Environmental Advisors (SRU) in its 1998 annual report.

Avoiding pollution – a matter of credibility

The problem of contaminated crops, seeds, foodstuffs and animal food is worsening as the number of transgenic plant varieties and the size of land used for their cultivation increases. Contamination can, for example, be due to pollen imported from neighbouring fields, loss of seeds during transport, or mixing during transport or processing. Experience over the past two years shows that this is a real problem because contaminated seeds repeatedly reached regular cultivation areas both in Germany and in other European countries. These cases of GMO contamination which also affected the EU through imported products triggered a debate on the need for limit values. The EU Commission addressed this need in its draft EU Regulation on Genetically Modified Food and Animal Food.

Experience shows that without additional protection measures it is practically impossible to completely prevent contamination. This is a particular problem for ecological farming. Since the *EC Regulations on Organic Production of Agricultural Products (Regulations 2092/91/EEC and 1804/99/EEC)* prohibit the use of GMOs in eco-products, the production and sales possibilities for eco-farming would be seriously damaged because eco-products with a GMO content subject to a labelling obligation are practically impossible to sell.

A research project carried out on behalf of the UBA by the Freiburg-based Öko-Institut aims to identify possible solutions to enable the protection of GMO-free farming. The results of this project will serve as a basis for recommendations for reducing GMO immissions into GMO-free production. Solutions which are currently under discussion include separate flows of goods and separate processing routes, with empirical material on these issues available from Switzerland. In 2001, studies of ways to separate the flows of goods and hence to avoid GMOs in certain foodstuffs were conducted on behalf of the Swiss Federal Health Office [15].

A test designed to assess the risk of mixing conventional and genetically modified products in a corn mill showed that conventional cleaning processes between two batches carried out up to now in order to separate conventional and organic corn failed to prevent the mixing of conventional products and genetically modified corn previously treated in the mill. In order to comply with the labelling limit of a GMO share of less than 1 % in the following batch, the first 750 to 1,000 kilogrammes (kg) – corresponding to 15 % to 20 % of the post-GMO batch – had to be separated and declared as GMO. Comparing: The usual volume used to separate conventional products from organic products totals 200 to 500 kg. The authors of the study conclude that more far-reaching measures are necessary in order to rule out mixing even of trace amounts. Sufficient separation of production flows is only possible using physically separate processing facilities. This would then mean that organic products can only be processed in plants and mills where no genetically modified products are processed.

Other measures which are being discussed in order to minimize contamination with GMOs include variety-specific distances between land used for eco-farming and land with GMOs, as well as an option to protect particularly susceptible areas against GMO contamination (so-called GMO-free zones). Variety-specific distances are also used, for example, in conventional plant breeding in order to avoid mixing of seeds from different varieties. A minimum distance of 200 m, for example, must be maintained between fields with different corn varieties. In the case of rape, a distance of 200 m (basic seeds) or 100 m (certified seeds), respectively, must be adhered to, depending on seed quality. “GMO-free zones” require substantially larger distances than variety-specific fields in terms of field sizes. The UBA has commissioned a legal opinion which also has to address the question as to whether and how such protective measures can be enacted. The aim is to develop a plausible and practicable solution which protects eco-farming and conventional, GMO-free farming whilst at the same time ensuring a reliable legal situation for all farmers.

(IV 2.5)

[15] Warenflusstrennung von GVO in Lebensmitteln. (GMO segregation within food supply chains). Final report, Prognos AG Basel, in co-operation with FiBL Frick et. al, Basle, Switzerland, February 2001, available on the Internet at www.bag.admin.ch/verbrau/lebensmi/gvo/d/endbericht_prognos.FDP.

4. Inseparable: environmental protection also means nature conservation

Overview

- Introduction
- Intensive livestock farming
- Protection of biological diversity
- Space-orientated environmental planning
- Environmentally compatible tourism
- Summary

Introduction

One of the major challenges at the beginning of the 21st century is to protect nature with its enormous variety of habitats and its vast stock of animal and plant species. Admittedly, It would be unrealistic to believe that nature conservation alone would be able to achieve this. Former president of Deutscher Naturschutz-Ring (DNR), Prof. Dr. Wolfgang Engelhardt, notes: "Man's natural environment is an entity", and concluded: "There is no ... scientific justification for the segregation of nature conservation and environmental protection, nor does any administrative reason exist for this". [16]

Needless to say that instruments of so-called classic nature conservation – i.e. the protection of species and biotopes (habitats) – continue to be relevant, but each of these instruments alone has only a limited effect because many important factors which influence their aims are beyond their sphere of influence. What is needed is strategies of integrated environmental protection, including nature conservation and covering multiple environmental media and demand fields. This is the only way to effectively implement the protection of natural resources as one of the public aims laid down in the German constitution [17].

In recent years, the Federal Environmental Agency (UBA) has developed a host of concepts and initiated and successfully concluded many projects which focus on these conditions. This chapter will present selected examples related to agriculture, biological diversity, space-orientated environmental planning and tourism.

Intensive livestock farming

Agricultural production today takes place in an environment of conflict between economic constraints, consumer-orientated and ecological quality targets, as well as social responsibility (refer also to chapter 1). This is particularly true for animal husbandry, above all, in areas where this is geographically concentrated. The purely economic orientation of "animal production" in the past reduced animals to a raw material and triggered a range of environmental problems, such as excessive ammonia, methane and dinitrogen oxide emissions into the atmosphere and immissions of reactive nitrogen compounds into soils and waters.

Animal husbandry on farms accounts for more than 80 % of ammonia emissions in Germany. These emissions lead to precipitation and accumulation, chiefly in the form of ammonia compounds. Ammonium accumulated in soils has an acidifying and eutrophication effect (excessive accumulation of nutrients). Ammonium accumulation causes new types of damage to forests and endangers the supply of raw water for use as drinking water. The critical nitrogen compound loads (refer to chapter 1) are exceeded in large parts of Germany.

The aims of nature conservation are also at risk. High nitrogen compound accumulation rates can endanger plant populations at low-nitrogen sites. More than 70 % of Germany's plant species classified as endangered according to the "Red List" grow on low-nitrogen soil and have a crucial competitive advantage on

sites with low nitrogen content. However, even with low nitrogen immissions, they are at a disadvantage compared to plants with a stronger growth potential. Persistently high nitrogen immissions can lead to significant changes in the variety of species and hence endanger threatened biotopes and biocoenoses (communities of plants and animals) even further.

In 1999, Germany undertook within the scope of the *Convention on Long Range Transboundary Air Pollution (LRTAP)* to reduce its annual ammonia emissions from a current figure of around 650 kilotonnes (kt; 1 kt = 1,000 tonnes) to 550 kt by the year 2010. The emission limits so far agreed aim at a 50 % reduction of the area on which the critical immission rates are exceeded. This would mean that an important intermediate target for the protection of delicate ecosystems (which include forests in Germany) would be achieved. The long-term target should, however, still be to achieve immission rates below the critical levels throughout Germany.

Over the past two years, the UBA has supported and subsidized several research projects that have substantially improved the technical basis for national and international emission reporting. This applies also to the assessment of reduction potentials offered by different options for action. It is now possible to differentiate annual ammonia emissions for each animal species for the different husbandry forms and thus to identify technical measures for reducing emissions [18]. Tables 1 and 2 show selected examples.

Another project aimed at identifying the best available husbandry techniques [19]. It provides the technical basis necessary for ensuring a technically high environmental protection level for animal husbandry in Germany. The results of the project also represent the German contribution to the European harmonization of approvals for intensive animal husbandry facilities within the scope of the so-called "Seville Process" (refer to chapter 10).

Protection of biological diversity

The earth's biological diversity offers mankind a host of possible uses. For thousands of years, plants and animals have served as food and raw materials for the production of the most varied goods. Today, biotechnology and genetic engineering firms also use mainly micro-organisms and gene sequences of many animal and plant species. In order to control access to genetic resources world-wide, guidelines

Table 1: Selected examples of ammonia emission factors for husbandry or animal breeding systems

Type, use, housing, fertilizer storage	*Ammonia emission factor (kg of NH_3 per animal unit per year)*
Fattened pigs	
Forced venilation, liquid-manure method (partial or full-grille floors)	*3.64*
Outdoor housing, deep-hay or compost method	*4.86*
Piglet production (breeding-sow husbandry)	
All areas and housing types (breeding sows, including piglets up to 25 kg)	*7.29*
Laying hens	
Batteries with ventilated faeces conveyor	*0.0389*
Voliere with ventilated faeces conveyor	*0.0911*
Dairy stock	
Tied-up stock, solid or liquid-manure methods	*4.86*
Lying boxes, solid or liquid-manure methods	*14.57*

Table 2: Measures for reducing ammonia emissions

Emission reduction measures		*Cattle*	*Pigs*	*Poultry*
Keeping	• *Outdoor housing*		*X*	
	• *Large groups*		*X*	
	• *Grille-floor housing*	*X*		
	• *Manure conveyor with ventilation*			*(X)*
Feeding	• *Adapted feeding*		*X*	*(X)*
Storage	• *Covered manure container*	*X*	*X*	
	• *Extended storage capacity*	*X*	*X*	
Application	• *Use of emission-reducing application equipment*	*X*	*X*	
	• *Immediate application (1–4 hours)*	*X*	*X*	*X*
	• *Manure diluted with water*	*X*		

were developed during a meeting of UN experts on the *Convention on Biological Diversity (Biodiversity Convention)* in Bonn in October 2001 that aim to ensure the sustainable use of genetic resources and the fair distribution of the benefits from their use.

The welfare effects from ecosystems are of particular interest for environmental protection, such as the preservation of soil fertility by microbial activity or the self-cleaning capability of waters. The 6th conference of the scientific committee of the Biodiversity Convention in March 2001 addressed the interaction between world climate and biological diversity as a topic of particular importance. The UBA is intensifying its international co-operation on this issue (refer to part 2, pages 109 and following).

The effective protection of biological diversity is a precondition for ensuring the continued availability of its potentials for future generations. The concept of sustainable use offers a suitable framework for this, but still requires a more precise definition of contents. Above all, co-ordinated goals and scales are needed in order to be able to assess whether or not a particular form of use is sustainable. In a first step, the UBA has analysed the evaluation scales used in all of its fields of activity, and has identified areas where action is necessary.

Furthermore, the "non-native species" (neobiota) issue is currently being addressed by the convention. Apart from habitat losses, the world-wide spread of non-native species is increasingly affecting and changing original, native communities of animals and plants. Examples from Germany include the hogweed (heracleum), the raccoon dog and the American mink.

In a research project supported by the Agency, the Institute for Biodiversity at Rostock University presented a first, exhaustive overview of non-native animal species in Germany, including their origin and damage potential [20]. Another research project that was supported by the UBA and conducted by the Zoological Institute at Munich University showed that non-native fish populations in German waters (such as non-native river trout or saibling from Alpine lakes) are replacing native species and thereby affecting local genetic diversity [21].

Geographically orientated environmental planning

At the end of the 1990s, urban development *(Construction Code)* and regional planning *(Regional Planning Act)* legislation was amended by adding sustainability as another imperative. At the same time, the importance of nature conservation was increased and soil protection clauses were introduced for all planning levels. This means that the conditions for improved protection of free spaces in the interest of sustainable development of the overall space are in

place. As an additional measure, the protection of free spaces was made part of the sectoral planning approach to nature conservation *(Federal Nature Protection Act,* 2002).

Although the conditions for sustainable development of cities and municipalities were improved in urban development legislation, the municipalities themselves remain responsible for planning and action-orientated implementation.

Within the scope of the obligation to balance out conflicting interests (section 1, subsections 5 and 6 of the *Federal Construction Act*), "sustainable urban development" is regarded as being the result of a fair balance of economic, ecological and social interests. The ecological aspects of the sustainability requirement in planning law have been significantly strengthened since 1998 in relation to social and economic aspects. This is reflected by:

- The general urban development aim of a careful use of land and a limitation of land sealing for housing, business and transport.
- The requirement to create compact settlement structures.
- The priority given to developing city centres and to re-using derelict land over new developments.
- The integration of the impact regulation under nature protection law into urban land use planning.
- The preservation and networking of ecologically effective open spaces.

This means that urban land use planning was given a direct ecological responsibility. By integrating environmental interests into urban land use planning, the legislator has created an instrument which is more effective than pure co-operation between planning functions – regional planning on the one hand, environmental and nature protection planning on the other – would ever have been able to achieve.

Environmentally compatible tourism

An intact environment is an important precondition for lasting economically successful tourism. Reducing environmental burdens is hence an important aim of environment-friendly tourism. Environmentally compatible tourism can also help protect particularly delicate natural spaces. In order to promote public awareness of this protection aim, the United Nations announced 2002 to be the "International Year of Eco-tourism".

Eco-tourism covers a specific group of tourism products in so-called nature tourism. This form typically focuses on guided nature and culture experience in protected areas. The large protection areas in Germany are good examples of the possibilities which synergies between tourism, nature conservation and agricultural use can offer, even with a view to sustainable regional development. What is lacking in most cases is not innovative concepts and creative ideas on the part of the actors, but the effective marketing of environment-friendly tourism offers by rural regions.

The Federal Ministry for the Environment (BMU) and the UBA took this opportunity to launch the "Experience nature in Germany" project within the scope of the Alliance for Employment (working group "Development of rural spaces – sustainable tourism"). In this project, Deutschland Touristik GmbH, Pfarrwerfen (Austria), created the organizational and technical framework for package tours to protected areas in Germany with an online offer and booking system. [22].

With the environmental "umbrella" label Viabono, the Alpenforschungsinstitut (AFI), Garmisch-Partenkirchen which was commissioned by the UBA is breaking new ground for developing and marketing environmentally compatible tourism offers. Rather than awarding different environment-related quality labels for individual products – an approach which in the past failed to yield any competitive advantages for environmentally compatible products – products offered under the Viabono brand (Figure 4) are designed to combine holidaymakers' desire for quality, convenience, health and safety with the feeling of spending an environment-orientated holiday. Viabono represents quality offers in the field of environmentally compatible tourism which were tested on the basis of comprehensive criteria (refer to the 2000 Annual Report).

Figure 4: Viabono, the environmental umbrella brand

More than 20 leading tourism and environmental protection associations support the concept and the introduction of Viabono as an environmental umbrella brand. Its brand philosophy is supported by all the parties involved, and is the result of a trail-blazing political initiative in national tourism.

After eighteen months of preparations, Viabono was launched as an independent brand in October 2001 after Viabono GmbH, Bergisch-Gladbach, had already started operative business in spring 2001. Within just six months, this marketing company not only established the central portal at www.viabono.de on the Internet as the most important distribution channel for Viabono products, but also implemented a target-group orientated internal and external marketing system. After less than three months, more than 30 hotels and restaurants, as well as the first municipalities and natural parks have adopted the Viabono brand. Another 30 hotels and restaurants had applied for a license by the beginning of 2002.

Summary

The largest part of living space in Germany is used by man. Besides the establishment of sufficiently large and cross-linked protection areas (development of a networked system of biotopes spanning the federal states) and apart from reducing the new use of land for housing and transport, the way in which areas are used also plays a central role. This is particularly true for agriculture and forestry, sports, tourism, leisure and recreation, as well as the protection of natural resources. This means that demand for strategies for the sustainable development of rural regions will continue – including sustainable land use, i.e. compatible forms of land use adapted to the characteristics of the surrounding landscape.

(I 1.2, I 1.4, I 2.3, II 1.1, II 1.3)

[16] "Ökologischer Unsinn" (Ecological nonsense) in: Politische Ökologie 43, November/December 1995

[17] Article 20 a of the German Constitution (principle of protection of the environment): "The state, also bearing responsibility for future generations, protects the natural resources within the scope of the constitutional order by its legislation and by the executive and judicative branches on the basis of the rule of law."

[18] BMVEL/UBA Ammoniak-Emissionsinventar der deutschen Landwirtschaft und Minderungsszenarien bis zum Jahre 2010 (Ammonia emission inventory of German agriculture and reduction scenarios up to 2010) (TEXTE 05/02), available from Werbung + Vertrieb, address on page 90).

[19] "Emissionen der Tierhaltung und Beste Verfügbare Techniken zur Emissionsminderung", (Emissions by husbandry farms and best available practices for emission reduction" KTBL-Schrift 406 (in preparation, scheduled for publishing in June 2002)

[20] Bestandsaufnahme und Bewertung von gebietsfremden Tierarten (Neozoen) in Deutschland (Stock-taking and assessment of non-native animal species (new invasive species) in Germany (TEXTE 25/02), available from Werbung + Vertrieb, address on page 90).

[21] Veränderungen der genetischen Vielfalt: Molekulare und populationsökologische Charakterisierung autochthoner und durch Besatz beeinflusster Salmoniden-Populationen (Bachforelle, Alpen-Seesaibling) in Bayern (Changes in genetic diversity: molecular and population-ecological characterisation of autochthonous and new populations of salmonids (river trout, Alpine lake saibling) in Bavaria (TEXTE 48/01), available from Werbung + Vertrieb, address on page 90).

[22] Since autumn 2001, the offer has been available on the Internet at www.deutschlandtouristik.de.

5. Climate protection and sustainable energy use

Overview

- Introduction
- The Third Assessment Report on Climate Change
- The international negotiations on the Kyoto Protocol
- Assessment of climate protection measures with cogeneration processes
- Development and promotion of renewable energies
- Using biomass energy
- Bio-fuels – a recommendation with restrictions
- Wind energy use in the North Sea and Baltic

Introduction

2001 was a year of outstanding importance for international climate protection. The Third Assessment Report by the Intergovernmental Panel on Climate Change (IPCC) was issued. Secondly, the negotiations – above all, in Bonn and, confirming the Bonn results, in Marrakech – paved the way for the Kyoto Protocol to come into effect. The Federal Environmental Agency (UBA) was involved in both measures. Although different views exist with regard to the Kyoto process, the Agency considers the result to be a success.

Climate protection is a central motivation for the sustainable use of energy. However, the UBA's study titled "Sustainable Germany – Ways Towards Long-term Environmental Development" (refer to chapter 1) showed that even achieving very ambitious climate protection aims alone does not ensure sustainable development. Although nuclear energy does indeed offer certain advantages during power station operations in terms of climate protection, nuclear energy fails to meet with the "low risk" and "error tolerance" sustainability criteria as important yardsticks for sustainable energy use. Furthermore, radioactive waste must be stored for millenniums and thus poses a considerable risk. Similarly, fossil fuels fail to offer "secured supply" and "openness of use options" as sustainability criteria. These fuels are exhaustible, so that their use is not sustainable.

In view of our far-reaching responsibility for life on earth, apart from climate protection, sustainable and hence environmentally compatible use of energy must also be promoted. The UBA hence feels committed to the related aims, i.e. energy-saving and efficient use of energy, as well as promoting renewable sources of energy as an alternative to today's energy system. The UBA is thus intensively working on the related issues, with examples being presented in this chapter. In line with this determination, the units working on new energy technologies and climate protection were expanded in 2001. *(I 2.5)*

The Third Assessment Report on Climate Change

In its comprehensive third report, the IPCC compiles the entire current scientific state of information on causes, effects and options for action related to global climate change. With this report, the authors have created a sound scientific basis for international negotiations. The draft reports were critically reviewed by experts and government representatives. The UBA was involved to a great extent in this work.

Scientific basis: Work group I found that our climate has changed significantly over the past two decades. During the 20th century, the average global temperature increased around 0.6°C (with an uncertainty of +/- 0.2°C). This is the strongest temperature increase in the northern hemisphere over the past 1,000 years. The 1990s was the warmest decade world-wide (with seven of the ten warmest years occurring), and 1998 was the warmest year during this period. The sea level rose in the past century by 10 to 20 centimetres (cm). The concentration of

GREENHOUSE GASES in the atmosphere increased further as a result of human activities, with carbon dioxide and methane reaching the highest values in 420,000 years.

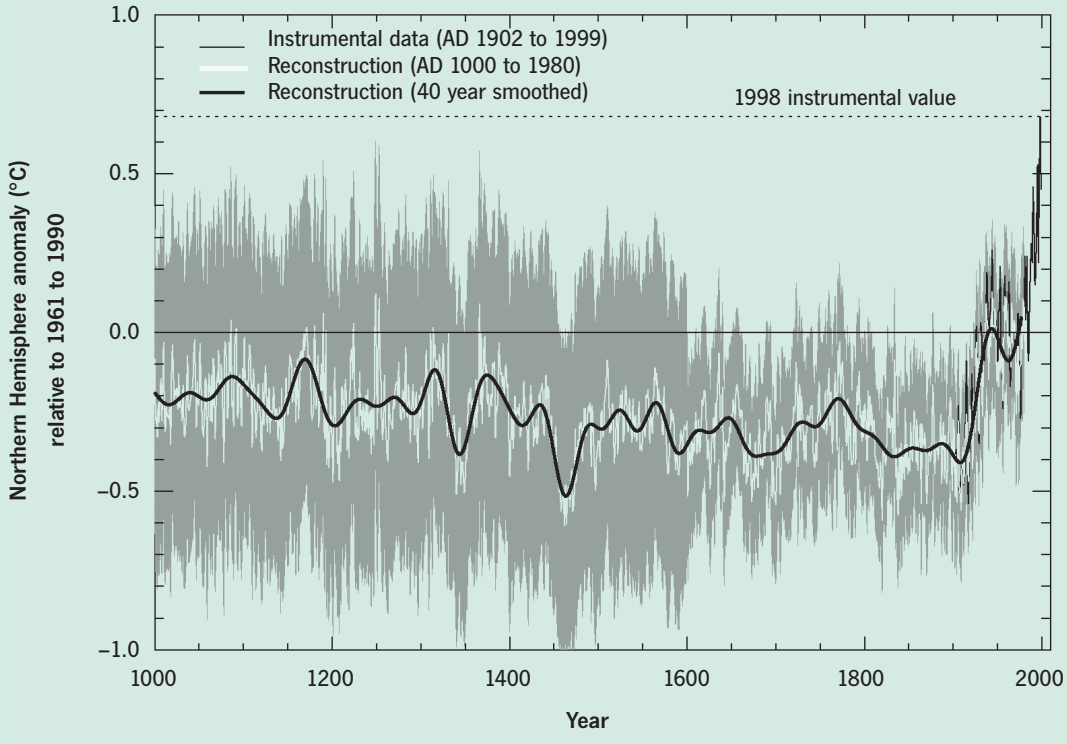
Greenhouse gases: *Greenhouse gases are atmospheric gases which absorb and emit heat radiation released by the earth surface, the atmosphere and the clouds (greenhouse effect), in particular, steam (H_2O), carbon dioxide (CO_2), ozone (O_3), dinitrogen oxide (N_2O) and methane (CH_4). Long-life halogenated hydrocarbons are among the most important man-made greenhouse gases.*

Studies into the causes of the climate changes observed, covering both the increased emissions of greenhouse gases as well as changes in solar activity and volcanism, lead to a clear conclusion. Recent and more robust results suggest that most of the temperature increases over the past 50 years are due to human activities.

The climate models calculate a temperature increase of 1.4 to 5.8°C and a rise in sea level of 10 to 90 cm by the year 2100 for a very broad range of emission scenarios. The rate of climate change since the end of the last ice age would thus be unparalleled and without any analogy in the history of civilization. (Figure 5).

Effects and adaptation: Working group II found that climate change will have mostly negative effects on man and nature. Some of the effects are already visible. Glaciers are on the retreat, and animals are changing their nesting and migrating patterns. The effects of change will worsen with rising temperatures. These include drinking-water shortages and floods, hunger and disease. Agriculture is threatened by a shortage of water in many regions. The negative consequences can be substantially alleviated by adaptation which is always a reactive process in nature (migration of species), but which can also have a preventive effect in social systems (changes in land use or farming patterns and policies, changed distribution and pricing for water, disaster protection). However, many developing and newly developed countries are

Figure 5: Changes in earth surface temperature



Source: IPCC Policy Makers Summary

subject to geographical conditions that make them more vulnerable to the consequences of rising temperatures than industrialized nations. Furthermore, the economic adaptation options of developing and newly developed countries are more limited than those of industrialized nations. The countries which are today among the poorest and which have the smallest economic potential will be generally among those hardest hit by the consequences of climate change. Ironically, these countries are not the main culprits.

Emission reduction: The most important findings by working group III was that the causes of climate change can be significantly reduced by suitable technical and organizational measures and by changed patterns of behaviour. If the emission reduction technical measures already available on the market were adopted on a global scale, global greenhouse gas emissions could be reduced to below the levels of the year 2000 between 2010 and 2020.

Half of the measures necessary to this effect are considered to be economically reasonable, i.e. they yield a net profit during their typical life span. The other half can be achieved at a cost of up to US$ 100 per tonne of carbon dioxide equivalent. Calculations based on macro-economic balance models show for the industrialized nations that the emission reduction goals of the Kyoto Protocol will lead to a decline in gross domestic product by 0.2 to 2 percent in 2010. In most cases, however, the decline in gross domestic product will be less than one percent. This loss can be reduced by 50 % by "free emission trading".

The UBA's conclusion: The IPCC's Third Assessment Report explicitly confirms the UBA's view which the Agency has been endorsing for many years, i.e. that climate protection measures are urgently needed in order to reduce the effects of climate change and thus to protect human health as well as unique ecosystems and in order to initiate sustainable economic development. This has never before been so obvious. Efforts must be intensified both at a national and at an international level in order to reduce greenhouse gas emissions which the IPCC also considers to be the main cause of climate change that is currently underway.

Apart from a further reduction of climate gas emissions, measures are urgently needed in terms of an adaptation to climate change. The ratification of the Kyoto Protocol must be accelerated at an international level. This will be the only way to keep the effects of climate change described in the IPCC report at a level that avoids drastic impairment of the quality of life world-wide.

The international negotiations on the Kyoto Protocol

Negotiations on an international convention to bring about a solution to the problem of global climate change have been underway since 1990. The development of the *Framework Convention on Climate Change* in 1992 in Rio de Janeiro (Brazil) was followed by the *Kyoto Protocol* in 1992 which became mature for ratification by the negotiations in Bonn and Marrakech in 2001. Detailed procedures for the implementation of the Kyoto Protocol were decided upon during these negotiations. These procedures concerned, for example:

- The system of performance checks and reporting obligations
- The possibility to set off sinks (see below)
- The "Kyoto mechanisms" of Joint Implementation (JI), Clean Development Mechanism (CDM) and emission trading. The Kyoto mechanisms enable the qualification of climate protection projects outside a country's own borders, so that measures can be implemented at an international level in places where this can be carried out most cost-effectively.

In order to come into effect, the Kyoto Protocol must be signed by at least 55 nations which must account for at least 55 % of all CO_2 emissions of the Annex-I countries. Germany has ratified the protocol together with the EU and the other EU member states.

The discussion on sources and sinks from land use, on changes in the use of land and forests which the UBA considered to be critical played a central role during the negotiations. The photosynthesis process of plants eliminates carbon dioxide from the atmosphere. The terrestrial biosphere is hence a sink for atmospheric carbon dioxide – but a sink which can quickly become a source in the case of fire, climate change, inappropriate use. Human actions can increase (afforestation, forestry) or reduce (deforestation, intensive ploughing) this sink effect.

The Kyoto protocol offers the possibility to receive credits for measures related to land use, changes in

land use and forestry (sinks) as an additional way for a country to meet with its emission reduction obligations. Germany was eager to prevent undermining of the Kyoto Protocol which demands, first and foremost, a reduction of greenhouse gas emissions.

Limits were imposed after tough negotiations. The industrialized nations (except for the US) referred to as the Annex I states will be entitled to around 110 million of carbon sink credits per year. In this way, around 2.3 % of the emissions of the reference year can be used to fulfil the obligations under the Kyoto Protocol.

The contracting states once again confirmed the need for more intensive co-operation between the *Climate* and *Biodiversity Conventions* and *UN Convention to Combat Desertification*. The UBA proposed concrete steps for developing this co-operation further. This means, for example, that national plans for action for the implementation of the conventions must be co-ordinated primarily in order to avoid conflicts between the individual protection aims when it comes to the planning of measures. Carbon sink or adaptation projects in climate protection should only be carried out, for example, if they do not jeopardize the protection aims of the Biodiversity Convention. Furthermore, the reporting obligations should be harmonized between the different conventions in order to avoid overlapping and redundant work. *(I 2.7)*

Assessment of climate protection measures with cogeneration processes

Cogeneration in power production means the simultaneous production of electricity and other secondary energy carriers (such as heat, cold, compressed air) whilst using the energy contents of the energy source (coal, natural gas or biomass) to the maximum extent possible. The most familiar cogeneration process is that of combined power and heating stations, as well as the combination of distributed power stations in a power supply network.

In order to assess and improve cogeneration processes from an environmental and energy-political point of view, the emissions must be correctly attributed to the amounts of energy generated. Several assignment methods are available for this purpose, however, each one leading to different results. What matters is that the same method has to be adopted when two plants are compared. This means that the method actually adopted must also be identified if a plant or a measure for its improvement is claimed to be a climate protection measure. Furthermore, balance limits and ambient conditions must be specified on a comparable basis. The amount of emission is chiefly dependent on the fuel and the emission reduction technology and secondly on the energy conversion process.

These issues were compiled and described within the scope of VDI guideline 46 60 with the UBA's co-operation. [23] *(I 2.6)*

Development and promotion of renewable energies

Besides more efficient energy conversion and use, energy saving, the establishment of decentralized power supply systems and the replacement of nuclear energy, sustainable use of energy requires that fossil fuels be increasingly replaced by renewable forms of energy. This calls for efficient tools which support the market introduction of renewable energies. Power generation from renewable energies – i.e. not just wind and biomass (see below), but also photo-voltaic technology – is recording tremendous growth rates thanks to the impact of the *Renewable Energy Source Act* and the "100,000-roofs programme". In 2001, the share of renewable energy sources in primary energy consumption rose to 2.3 %, or around 7 % in electricity production. The applicability of the Renewable Energy Sources Act was confirmed and strengthened by decisions by the European Court of Justice and the *EU Directive on the Promotion of Renewable Energy Sources*. A review of the Renewable Energy Sources Act will be submitted in a corresponding report to be published in mid-2002 with the UBA's co-operation.

Solar thermal power stations are still far away from general use for power generation. The sun's radiation density in Germany is rather low, so that this technology is more suitable for countries much closer to the equator. Germany supports a sustainable power supply in Europe. In this context, solar-thermal power stations are also of interest in view of future imports of regenerative electricity from southern regions. Furthermore, German companies possess extensive knowledge of the technologies needed for this application. One of the technologies promoted within the scope of the contribution by the Federal Ministry for

the Environment towards the federal government's future investment programme is hence high-temperature solar thermal power generation, as well as the use of geothermal energy for power generation and parallel ecological research into the use of biomass, fuel cell technology and the use of wind energy in marine applications. The UBA is involved in the assessment and further support of the research project conducted by the Federal Ministry for the Environment.

Renewable energy sources can also play an important role when it comes to the use of heat. Low-temperature heat accounts for the greatest part of Germany's heat demand, and the greatest part of this can be covered by renewable energy sources. Wood is so far used for heating to a limited extent. Solar collectors currently cover only around 0.2 % of the heat demand of residential buildings. Distribution to users (apartments, for example), which sometimes require district heating networks, plays an important role in the cost-effective use of renewable energy sources. When it comes to heat generation or distribution, there are still no instruments available which could have an impact similar to that of the *Renewable Energy Sources Act*. Action is urgently needed in this respect.

Financed with funds from the Ecological Tax Reform, a market incentive programme with a growing volume was launched in order to farm out substantial subsidies for renewable energy sources in the heat sector. The recently enacted *Energy Saving Ordinance* also facilitates the use of renewable energy sources for energy supply in buildings. The UBA additionally supports and promotes the development of suitable instruments, for example, in the form of a research project that aims to identify and lower the barriers to the market introduction of large solar panel installations on residential buildings. *(I 2.5)*

Using biomass energy

There is no other renewable energy sector that is as diverse as the bio-energy sector. This complex includes solid, liquid and gaseous fuels which can be used in different kinds of technical systems, such as furnaces of all sizes, motors and engines or fuel cells. Large quantities of usable biomass are produced as waste materials in forestry and agriculture, as waste in the wood or food processing industry, or as bio-waste in households. Additional quantities of biomass are produced specifically for use as a source of energy.

The extent of the potential that can be developed and the fact that they can often be developed at a relatively favourable cost render bio-energy sources a vital part of a sustainable energy mix with a large share of renewable energy sources. The Renewable Energy Sources Act significantly improved conditions for the production of electricity from biomass. Power station operators are paid an output-dependent price of up to 10.23 cent per kilowatt-hour of electricity which they feed into the public power supply grid.

In view of the large number of options, it is obvious that not every use of biomass for power generation makes sense from an environmental point of view. Particular consideration must be given to environmental protection interests when it comes to instruments aimed at promoting the use of biomass for power generation, so that negative developments can be avoided.

Considerations of this kind motivated the legislator to add an authorization clause to the Renewable Energy Sources Act. This new clause obliges the Federal Ministry for the Environment – subject to agreement with the Federal Ministry of Consumer Protection (BMVEL) and the German Federal Ministry of Economics (BMWi) – to issue legal regulations setting forth which substances are to be classified as biomass within the scope of the Renewable Energy Sources Act, which processes may be used for this purpose and which environmental requirements must be adhered to in this context.

Immediately following enactment of the Renewable Energy Sources Act in spring 2000, the UBA set up a project group which developed a draft regulation with the involvement of experts from various department units of the UBA. Although a first draft regulation was submitted in early summer 2000, there was a considerable need for discussion and co-ordination, so that the *Regulation on the Generation of Electricity from Biomass (Biomass Regulation)* came into effect on 28 June 2001 following ratification by the German Bundestag and Bundesrat. Particularly important and previously controversial aspects of power generation from biomass have now been given a clear legal foundation. This applies particularly to the conditions under which old and used wood is classified as biomass within the scope of the Renewable Energy Sources Act. Furthermore, the large number and diverse range of raw materials for biogas production have now been clearly defined.

The many investment decisions for biomass-based power plants which were made right after the coming into effect of this regulation show how important the provisions of the biomass regulation are. The industries concerned also showed an overwhelmingly positive response. [24].

One important function of the UBA is to monitor and assess the effects of the biomass regulation. This led to the launch of the "Biomass regulation monitoring" project in autumn 2001 which will study until the end of 2003 the extent to which the aims of the biomass regulation are achieved, as well as areas in which adjustment may be necessary. First results published by the researchers show that the biomass regulation and the Renewable Energy Sources Act generate important impetus, in particular, with regard to the use of used and old wood for energy production. Assuming that around one fourth of all the used-wood (cogeneration) power stations planned will in fact be built, the installed electrical power of these plants would more than double to 600 megawatts by the year 2004 against 2001. The used-wood potential available for power generation would thus be used up to a very large extent. The UBA will closely monitor and analyse the further development.

As the share of renewable energy sources in the energy mix increases, questions related to the environmentally compatible use of these forms of energy also gain importance. The Federal Ministry for the Environment has thus significantly intensified its activities in ecological parallel research into wind energy, fuel cells and biomass, defining new focal points of research interests in its future investment programme. A project titled "Material flow analysis for a sustainable use of biomass for power generation" was launched in 2001 within the scope of the ecological parallel research into the use of biomass for power generation. This project involves a wide range of renowned research institutes.

Central tasks of this ecological parallel research are:

- To identify material flows and environmental impacts related to biomass supply and use
- To provide a public technical database on the use of biomass for power generation
- To compare processes using biomass for power generation within the scope of an eco-balance
- To develop a material flow model for scenarios on future use of biomass

As an important result of this project, recommendations for action will be developed for a more intensive use of biomass for power generation, taking potential suitable for sustainable use into consideration.

(I 2.5)

Bio-fuels – a recommendation with restrictions

In order to reduce the dependency of the transport sector on oil, the EU Commission recommends promoting alternative fuels, i.e. natural gas, hydrogen and bio-fuels. Bio-fuels should reach a share of 6 % of the fuel market by 2010. Measures to achieve this include the setting of minimum targets and tax benefits.

Under German cultivation conditions, rape-seed oil methyl ester (RME, so-called "bio-diesel") is currently the most favourable biogenous fuel variant. Thanks to a national tax exemption programme in conjunction with the continued payment of bonuses for the discontinuation of energy plant cultivation, the share of bio-diesel in the German fuel market is continuously increasing and currently totals more than 1 % of German diesel sales, corresponding to around 0.5 % of the German fuel market.

The UBA has revised its technical and professional view of the RME issue against this background. The critical assessment in the UBA's studies from 1993 and 1999 [25, 26] is still valid without restriction. Central weaknesses of bio-diesel production are low economic and energy efficiency as well as inefficient land use.

The serious negative environmental consequences of rape-seed cultivation in conventional farming have also been confirmed by recent studies [27]. The cultivation of rape-seed for the production of bio-diesel conflicts with intensive and extensive farming. Intensive rape-seed growing causes serious environmental burdens typical for conventional farming, for example, due to high fertilizer immissions. Extensive rape-seed cultivation, on the other hand, means that there is not enough land available to produce the relevant fuel quantities.

Even with regard to greenhouse gas reduction, which is often used as a strong point for bio-diesel, the use of fallow land for more extensive production of food and animal food leads to a stronger reduc-

tion of greenhouse gases than when the rape seed is grown on this land to produce bio-diesel. This is true despite the greenhouse gas emissions of diesel fuel that is not substituted or additionally needed in this case.

Especially with a view to the initiative by the EU Commission, the UBA thus believes that the promotion of and subsidies for bio-diesel fuels should be reduced rather than expanded. *(I 3.2)*

Wind energy use in the North Sea and the Baltic

It can be expected in the long term that wind energy in Germany will significantly contribute towards boosting the share of renewable energy sources. At the end of 2001, wind farms with a capacity of more than 8,750 megawatts (MW) were installed on mainland Germany. With a base load of 13 terawatt hours (TWh; 13 billion kWh), these wind farms accounted for more than 2.5 % of Germany's total electricity generation. Applications have been submitted for wind farms with an total installed power of 60,000 MW in the North Sea and the Baltic.

Considering the various protection and use interests, the UBA believes that a gradual expansion of wind power generation in the North Sea and the Baltic will make sense. This gradual expansion must be accompanied by plant-specific environmental compatibility studies in order to determine the actual repercussions on the marine environment. These studies will also have to deal with the further development and assessment of technical, organizational and regional planning measures which can be implemented on future development levels of offshore wind parks in order to avoid or mitigate adverse effects.

The search for locations for offshore wind parks involves a conflict of aims. Shallow-water areas of the North Sea and the Baltic are particularly interesting for technical and financial reasons. However, serious conflicts with nature conservation interests arise in coastal areas because large areas of Germany's North Sea and Baltic coasts are classified as national parks or as bird sanctuaries or so-called flora-fauna habitat areas. In coastal areas, conflicts also arise in terms of the landscape picture, as well as problems with competing uses, such as tourism, because the towers of the wind farms which are currently planned and designed for a nominal power of 3 to 5 MW can be up to 190 metres high.

In order to support the start of environmentally compatible wind energy use on the sea, the UBA launched a research project in 2000 in order to bundle and prepare the existing knowledge related to various environmentally relevant issues (such as benthos, fish, mammals, birds, noise, ship collisions). Solutions for further issues are to be developed [28]. Results are expected by the end of 2002.

Funds are earmarked in the federal government's future investment programme in order to finance the construction of research platforms in the North Sea and the Baltic at potential locations for wind farms. An initial amount of 15 million € will be available for construction and operation until 2003. A first platform is to be erected around 35 km off the North Sea island of Borkum. Further platforms will be located 80 km off the island of Sylt and in the "Kriegers Flak" area in the Baltic Sea.

The measuring platforms will be used for the physical/technical measurement of wind, waves, currents and ice drift, as well as a biologically orientated research programme which was designed by the UBA in co-operation with external scientists. One priority in this context will be ornithological radar studies because these measurements when performed on ships are subject to stronger weather influences due to the waves. *(II 3.3)*

[23] These issues were compiled and described within the scope of VDI guideline 4660 60 with the UBA's co-operation.

[24] The text of the Biomass Regulation and of the Renewable Energy Sources Act can be downloaded from the Internet at www.bmu.de.

[25] "Aktuelle Bewertung des Einsatzes von Rapsöl/RME im Vergleich zu Dieselkraftstoff" (An up-to-date assessment of the use of rape-seed oil /RME compared to diesel fuel) (TEXTE 79/99), available at Werbung + Vertrieb (address on page 90).

[26] "Ökologische Bilanz von Rapsöl bzw. Rapsölmethylester als Ersatz von Dieselkraftstoff" (Eco-balance of rape-seed oil and rape-seed oil methyl ester as a replacement for diesel fuel) (TEXTE 4/93), available at Werbung + Vertrieb.

[27] Jungk, N. and Reinhardt, G. A., Landwirtschaftliche Referenzsysteme in ökologischen Bilanzierungen: Eine Basisanalyse (Agricultural reference systems in eco-balances. A basic analysis), ifeu – Institut für Energie- und Umweltforschung, Heidelberg 2000.

[28] Intermediate results of this project are considered within the scope of the federal government's strategy for the use of wind energy on the sea, as well as in research projects of the future investment programme.

Further information can be downloaded from the Internet at www.umweltbundesamt.de/wasser/themen/offshore.htm and www.bmu.de, key work "erneuerbare Energien" (renewable energy sources).

Another study titled "Rechtliche Probleme der Zulassung von Windkraftanlagen in der ausschließlichen Wirtschaftszone (AWZ)" (Legal issues related to the approval of wind farms in the exclusive economic zone) (TEXTE 62/01) is available at Werbung + Vertrieb.

6. Environment and health – two sides of the same coin

Overview

- Introduction: The "Health and Environment" action programme (APUG)
- Focal issue "Children, Environment and Health"
- Nuisance caused by noise
- Pollutant emissions from construction products
- Furniture and other wood products
- Dust – pollution and effects
- Swimming-pool water hygiene

Introduction: The "Health and Environment" action programme (APUG)

In June 1999, the Federal Ministry for the Environment (BMU) and the Federal Ministry for Health (BMG) presented the "Health and Environment" action programme to the general public (refer to the 2000 annual report). This programme addresses the consequences of environmental pollution for health and aims at improving co-operation between the public authorities dealing with health-related environmental protection. The Federal Ministry for the Environment and the Federal Ministry for Health are supported by a co-ordination group from four supreme scientific authorities, i.e.:

- Federal Office for Radiation Protection (BfS).
- Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV)
- Robert Koch-Institut (RKI)
- Federal Environmental Agency (which also hosts the executive office)

An advisory group of representatives from non-governmental organisations reports to the ministries. The co-operation between the federal and federal-state governments is managed by the APUG project group and the Working Group of the Federal States on Health Protection (LAUG) as well as representatives of the "effect issues" sub-committee of the Regional Commission on Protection against Immissions (LAI). The APUG contains a host of tasks and measures in its two chapters on "cross-section tasks" as well as "media and substance-related quality aims". Here, some examples:

- Improving instruments and knowledge in order to prevent environment-related health risks
- Reducing environment-related health burdens by improving air quality, reducing noise, protection against the harmful effects of radiation or chemicals
- Improving environment-related health monitoring and reporting
- Improved handling of risks by optimizing standardization processes and organization structures, as well as development of early risk communication procedures

The activities on the subject of "Children, Environment and Health" are one of the focal issues in 2001 among the wide range of subjects of the APUG.

Focal issue "Children, Environment and Health"

Environment-related health risks: Children are particularly susceptible to many environmental burdens, and it is more difficult for children to avoid certain burdensome situations than for adults. Children are hence a risk group in terms of environment-related health problems. Typical forms of high risk exposure are hand-to-mouth contact, crawling and playing on the floor or in the sand, including the uptake or dirt when playing outdoors. Children have special physiological conditions, such as increased ventilation and resorption rates and are hence subject to a higher pollutant exposure than adults related to their body weight. Furthermore, the infant organism is still in the process of developing and sometimes demonstrates a stronger reaction to pollutants. Environment-related health risks for children are thus an important field of action within the "Health and Environment" action programme (APUG).

The focal issue "Children, Environment and Health" was set up within the scope of the electronic discussion forum on the action programme in order to intensify the debate on this topic. Information on this subject is available on the Internet at www.uminfo.de/aktionsprogramm. This forum is open for active discussion.

As far as the continuation of the "health-related environmental monitoring system (GUB)" is concerned, work is underway on its implementation on a permanent basis. Periods of seven to ten years between the surveys are too long from the point of view of environmental policy. The data available must be up-to-date, with a maximum sampling frequency of three years. The health-related environmental monitoring systems of the Federal Ministry of the Environment and the UBA will be reformed by merging several projects, such as the different surveys, the human specimen database, as well as individual projects. This would mean a strengthening of the health-related environmental monitoring system (GUB).

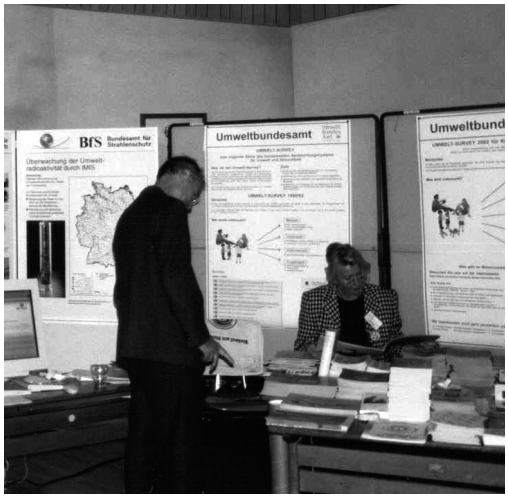
Children and youths survey: The information available on the spread of disease, on health-relevant attitudes and environment-related burdens on the population aged under 18 is insufficient and fails to provide any nation-wide comparative statements concerning the health condition of this age group. A health survey for children and youths is about to remedy this shortcoming, with an environment survey being linked to the health survey. It is being carried out as a joint programme by RKI and the UBA on behalf of the Federal Ministry of Education and Research (BMBF), the Federal Ministry for Health and the Federal Ministry for the Environment. The results of the children and youths survey will, for the first time ever, provide nation-wide, representative statements on the subject of "health and environment of children and youths".

The pilot phase (pre-test) for this unprecedented project in Germany took place from 1 March 2001 to 31 March 2002. At four different locations in Germany, 2,000 children and youths were examined in the health and 549 in the environmental part. The main phase of the surveys is scheduled for the period from 2002 to 2005 when 20,000 children and youths will be examined at 150 locations in Germany (health survey, with the environment survey to be carried out by random sampling of a sub-set of the children). [29]

The Children – Health – Environment Forum: The "Children – Health – Environment" Forum that took place in Munich on 23 and 24 November 2001 was designed to foster public communication on issues of environmentally related health protection for children, to disseminate information on relevant environmental influences and to explore and discuss ways to tackle these issues with the general public. This broad-based forum was also devised as a model for improved communication of environmentally related health risks. The forum addressed children, parents, scientists, politicians and representatives from industry, the media and the public health service. Some 900 visitors, among them around 250 children and youths, attended lectures, workshops, information and hands-on markets as well as discussions which were in part held in parallel (photograph).

The forum was designed and held by the Federal Ministry of Health and the Federal Ministry for the Environment with the Federal Office for Radiation Protection (organization), the Federal Institute for Risk Assessment, the Robert-Koch-Institut and the UBA (APUG liaison group) as well as the city of Munich and non-governmental organizations. [30] It was financed to the greatest part by the Federal Ministry of Health.

Exposure of children to plant protection agents: Within the scope of a research project on the "Exposure of children to plant protection agents", an international workshop took place in



A model for improved communication of environmentally related risks: The Children – Health – Environment Forum. (Photo: UBA)

Berlin from 27 to 29 September 2001. Scientists from Germany, its European neighbours and the US discussed issues of "anthropometric particularities", "toxicokinetic particularities", "behavioural patterns" and "exposure models" under risk assessment aspects for selected plant protection agents. Important reasons for separate risk assessment for children are the fact that real exposure patterns differ between children and adults and that the exposure of children is more difficult to estimate. All the attendees of the workshop are involved in the evaluation of its results. In order to implement these results, a document will be drafted which is to identify shortcomings which need to be urgently addressed, as well as to give recommendations for further research. The final report is scheduled to come out during the first half of 2002.

Information about children, environment and health: The focal topic "children, environment and health" was set up within the scope of the electronic discussion forum in order to intensify the discussion on the exposure of children to environmental influences. Information about this issue can be found at www.apug.de. This forum is also open for active discussion.

"Children, environment and health" will continue to form a central aspect of the work on implementing the "Health and environment" action programme.

(II 2.1)

Nuisance caused by noise

Of the many environmental influences currently discussed in public debate, the impact of noise is a top issue.

Noise can be both wanted and unwanted. Unwanted noise is an annoyance. This shows that the effects of noise depend not only on physical properties but also on a number of other, often psychological, parameters. The response to noise can thus vary within a wide range, and it is difficult to identify the influence factors precisely.

Noise can trigger different reactions, depending on the time (i.e. day or night), and can affect living conditions in many different ways. The adverse effects of noise include disturbed communication, recreation and relaxation, concentration and sleep.

Disturbed communication often causes an angry response because there is a risk that information may be lost or that it becomes more difficult to receive information. During the day, communication outside buildings is affected by noise with an average level of more than 50 to 55 decibel [db(A)]. In contrast to communication outside buildings where people can be reasonably expected to speak up when necessary, good understandability in rooms must be ensured even when speaking at a normal level. This means that annoying noise levels must remain below 40 dB(A).

More restrictive standards are recommended when it comes to protecting children against noise. Children do not have a fully developed acoustic memory yet and often have problems discriminating between words which sound alike even at noise levels where adults have no problems understanding each other. In classrooms, for example, interfering noise should not exceed a level of 35 dB(A). [31]

Noise additionally activates the organism, thereby potentially affecting recreation and relaxation. Only 20 percent of those polled by the UBA in a representative survey stated that they did not feel annoyed by noise. Noise is not only an annoyance, it also affects the ability to concentrate and hence to perform.

Noise can make it difficult to sleep, change an individual's sleeping phases or cause people to wake up too early. Considering the importance of sleep for health, one must assume that noise-induced sleep problems can also damage an individual's health. Noise-related sleeping problems can be widely avoided if the average noise level in bedrooms does not exceed 30 dB(A), with individual sounds being limited to a maximum of 45 dB(A).

No major problems can be generally expected at average noise levels outside apartments of below 40 dB(A) at night and below 50 dB(A) during the day. Under these conditions, levels of below 25 to 30 dB(A) at night and 35 to 40 dB(A) during the day are achieved in rooms with tilted windows. At average levels of above 55 dB(A) during the day outside buildings, there is an increasing risk that psychological and social well-being is being impaired.

In 2000, the UBA defined quality aims for air traffic noise protection:

- An air traffic noise level (outside buildings) of 55dB(A) during the day and 45dB(A) at night represent the threshold to severe annoyance.
- When air traffic noise levels (outside buildings) exceed 60dB(A) during the day and 50dB(A) at night, the risk of health impairment can no longer be ruled out.
- Air traffic noise levels exceeding 65 dB(A) during the day and 55 dB(A) at night mean that hazards for human health expressed as cardiovascular conditions can be expected.

These levels were once again discussed when it came to the revision of the *Act on Aircraft Noise*.

(I 3.4)

Pollutant emissions from construction products

Exposure in the home: Central Europeans spend around 80 to 90 % of the day indoors, i.e. at home, at their place of work and in means of transport, such as cars, buses and trains. Low-pollution air and a comfortable room climate thus contribute strongly towards well-being and health. In our homes, we are exposed to a host of chemical air pollutants, such as volatile and not easily volatilized organic compounds, dust and dust contents, as well as biological pollutants (primarily mildew). Hygienically acceptable concentration levels of these substances are not always ensured.

In particular, during the first weeks or months after renovation work and after moving into a new building, elevated concentrations of volatile organic compounds (VOCs) can occur in the room air due to emissions from construction or flooring materials. However, not easily volatilized substances can be released into the room air even years after a building has been completed or renovated. If a building is extensively sealed for energy-saving reasons during construction and renovation measures, so that the natural air change (i.e. the exchange of room and outdoor air through window and wall joints even with windows and doors closed) is significantly reduced, substances released into the room air can reach excessively high concentration levels.

Apart from chemical substances, microbiological impurities and, above all, mildew, are becoming increasingly important in such buildings. In buildings where natural air change flows are restricted by sealed joints and thermal insulation – apart from the further reduction of possible emissions of chemical substances from the construction products used – regular ventilation and adequate measures for discharging humidity are all the more so important in order to combat mildew, for example.

The relevant construction codes and guidelines demand that unreasonable annoyance and risks for the health of building users as a result of chemical and biological influences of construction materials be avoided. The required properties of construction materials will be laid down in harmonized standards and approvals within the scope of the *EU Directive on Construction Products*.

Not only construction and environmental authorities, but also users and anybody involved in the planning and design, construction and modernization of buildings are increasingly faced with the challenge of selecting the ideal construction materials with a view to minimum emissions. However, harmonized and generally accepted evaluation and testing methods are not yet available to this effect.

The "Blue Angel" eco-label helps: The marking of certain construction materials as low-emission products can serve as an orientation guideline. Besides the "Blue Angel" eco-label which is awarded by the eco-label jury (refer to chapter 9), some industries and trading associations have also developed their own marking systems as an expression of a growing awareness of their responsibility for the environment or as marketing instruments. Consumers, however, often find it difficult to come to terms with the growing number of different marking systems with their different awarding criteria, all the more so because these criteria often lack transparency and are hence difficult to compare.

In order to tackle these problems, harmonize the evaluation criteria and create a binding legal basis for emissions from construction products, the Working Group of the Federal States on Health Protection (LAUG) within the Working Group of Senior Federal Health Authorities (AOLG) established the Committee for the Evaluation of Health-related Impacts of Construction Products (AgBB) in 1997 which has its office in the UBA. Following intensive preliminary work, the AgBB published a document titled "Vorgehensweise bei der gesundheitlichen Bewertung von

flüchtigen organischen Verbindungen (VOC) aus Bauprodukten" (Procedures for the health impact assessment of volatile organic compounds (VOCs) from construction products) in order to have these requirements integrated into standards and construction permit regulations. The aim is to amend the technical rules for the implementation of the Construction Products Directive by proof of safety for human health, initially at a national level and later throughout the entire EU. [32].

The evaluation system sets health-related quality standards for the future production of construction products for indoor use. Its purpose is not to retroactively evaluate products that are already installed.

The results of the evaluation of construction products are also considered in the plans for the UBA's new headquarters in Dessau (refer to part 2, page 184).

The publication of the AgBB evaluation system marked the beginning of the exchange of opinions and experience with manufacturers of construction products, measuring institutes and consumer groups. The plan to develop a nation-wide, binding basis for assessing the impact of construction products on health has met with general acceptance. Quality marks issued by private organizations often lack transparent evaluation criteria, so that a comparison is almost impossible given the large number of such marks with a different focus. Although different views still exist on the individual aspects, the majority of experts consider the AgBB evaluation system to be a good foundation for further work. The issues still open are currently being discussed further with the active involvement of experts from manufacturers' associations and measuring institutes. One may expect that the adoption of the AgBB evaluation system will also have repercussions on existing quality marks. *(II 2.2, II 2.3)*

Flooring adhesives and flooring materials: The AgBB system for assessing the impact of construction materials on health is an important element when it comes to evaluating environmental and health-related characteristics during the product life cycle. Health impact assessments based on the AgBB system require a knowledge of the actual emission properties of products, as well as product-specific measuring strategies.

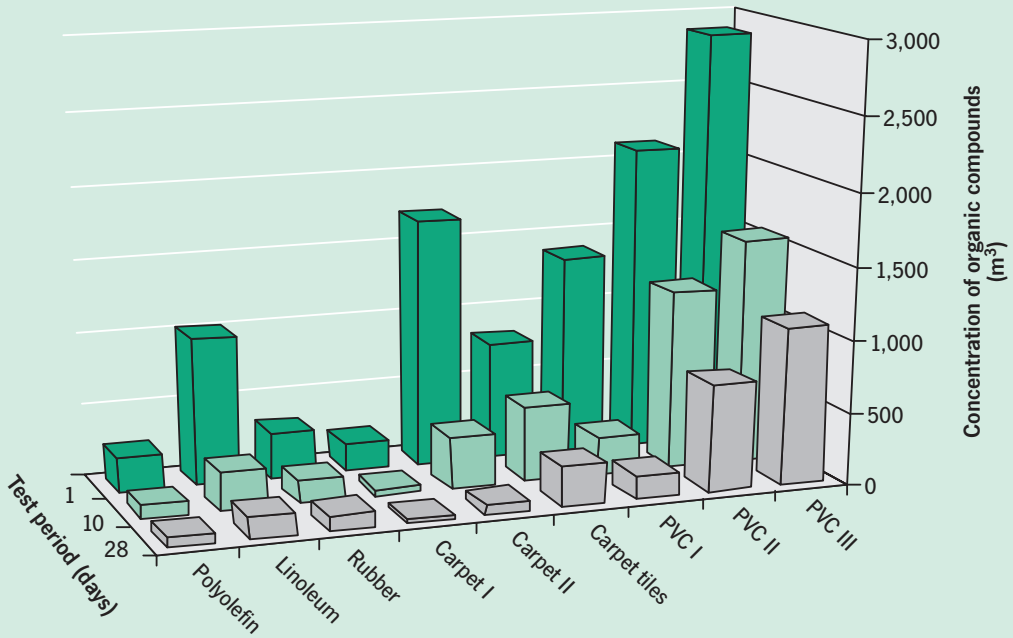
The Federal Institute for Materials Research and Testing (BAM) was commissioned by the UBA to study the emission relevance of numerous flooring adhesives and flooring materials in line with the criteria of the AgBB evaluation system within the scope of a research project titled "Analysis and determination of low-emission adhesives and flooring materials". The only flooring adhesives studied were products which are rated as "very low-emission" (equivalent to emission code EC 1) by the "Gemeinschaft emissionskontrollierte Verlegewerkstoffe (GEV)" (Society for low-emission flooring materials). Emission measurements in standardized test chambers showed significant differences between the initial emission rates of organic compounds. Although these differences become less pronounced after a few days, they basically continue to exist (with the maximum difference between emission rates corresponding to a factor of around 5 on the tenth day). On the 28th day, differences are in most cases very small. The measurements also showed that all the adhesives studied meet with the criteria for classification as "very low-emission" products in accordance with the GEV's specifications.

Figure 6 (page 48) shows the emission decay curves of samples of flexible flooring materials (linoleum, rubber and PVC) which were randomly determined over a period of 28 days. This example once again shows significant differences. Although emissions become less and less, substantial levels are still detected even after 28 days in some cases.

The results show that low-emission products are available in the market. It may sometimes be difficult, however, for consumers to identify such products. Some parquet and laminate flooring products are available with the "Blue Eco-Angel" mark. Although the eco-label can be applied for in the case of linoleum too, products bearing this label have not yet been introduced to the market.

Drawing on the results of this research project, the criteria for an eco-label and the related measuring conditions are developed initially for flooring adhesives in order to enable consumers to identify and select particularly low-emission products and thus to avoid negative consequences for the room climate. The UBA is also studying ways to develop criteria for an eco-label for flexible flooring materials. [33]
(III 1.4)

Figure 6: Emission behaviour of different flooring materials under standardized test chamber conditions



Furniture and other wood products

Besides construction products, furniture and fittings can also pollute the indoor air by emitting volatile organic compounds (VOCs). Different eco-labels were consequently developed for low-emission products. Since the beginning of 2001, the new "Blue Eco-Angel" for low-emission products made of wood and wooden materials has been replacing the former eco-label for low-formaldehyde wood products, considering not just formaldehyde emissions, but also VOC emissions into the indoor air. A whole series of home and office furniture, parquet and laminate flooring and lath grids now bear the "Blue Eco-Angel" label. This eco-label was awarded to large brand manufacturers and businesses in the skilled trades sector.

Two major aspects had to be considered when it came to developing the awarding criteria for the new eco-label. The first aspect was that emissions from furniture and other products made of wooden materials should be so low that they do not impair the user's general well-being. The second requirement was that – in line with the general purpose of the eco-label – only those products should qualify for the eco-label which in terms of their environmental properties belong to the upper third of the products available on the market.

The experience from the VOC emission measurements based on the BAM's testing method can be summarised as follows [3-6]: According to the qualification criteria, emissions from furniture are limited to a maximum of 600 microgrammes of VOC per cubic metre (µg/m^3) after 28 days in a standardized test chamber, whilst the corresponding figure for flooring materials, such as parquet and laminate flooring, totals 300 µg/m^3. The average emission values vary from product group to product group and, within a range from 80 to 120 µg/m^3, are significantly below the permissible maximum values. Many manufacturers were able to achieve this good result by using particularly low-emission surfaces, such as light-curing paints or melamine resins. In contrast to this, it is not possible to reduce emissions to below 300 to 500 µg/m^3 in the case of furniture with profiled, uneven

surfaces. However, a comparison with measuring results of products without the eco-label clearly shows that these values can also be considered as low. An emission value of 40,000 µg/m^3 was, for example, found for a solid-wood panel after 28 days under comparable conditions. Although the data material available is too limited to enable a statistical evaluation, the information so far generally suggests that the eco-label, as intended, was in fact awarded to the upper third of the products from an environmental and health perspective. [34, 35] *(III 1.4)*

Dust – pollution and effects

The debate on the effects of air pollution on health continues to focus on fine dust. Measurements of PM_{10} (fine dust with a grain size of less than or equal to 10 micrometers [µm]) pursuant to the *Council Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air* started in 2001 on a nation-wide basis. Scientific interest is increasingly focusing on smaller particles ($PM_{2.5}$) and ultra-fine particles, i.e. particles measuring less than 0.1 µm ($PM_{0.1}$). Ultra-fine particles play a special role in that in this case the number of particles per volume unit is determined rather than the mass per volume unit (as with $PM_{2.5}$ and PM_{10}). It is, however, still difficult to accurately measure airborne particles in outdoor air under changing external conditions as a basis for a meaningful analysis. The question as which grain size fractions or particle properties have a relevant impact on health is still difficult to answer.

Although there is reason to believe that the very small particles are particularly relevant for health, it is, above all, the particles which reach the deeper respiratory system which are likely to have the greater impact on health. Another point of interest is whether ultra-fine particles and particles with a grain size exceeding 0.1 µm have to be regarded as generally different forms of pollutants which must hence be detected and evaluated separately. The revision of Directive 1999/30/EEC scheduled for 2003, as well as intensive studies in the context of the "Clean Air For Europe" programme (CAFE, refer to part 2, page 140) are to address the progress in scientific development and to integrate new findings of cause-and-effect research and measuring technology into the process of defining limit values. The UBA will be involved in this effort within the scope of a European work group.

Swimming-pool water hygiene

Reducing health risks: Bathing and swimming are not just popular leisure activities, but also one of the most effective measures to protect health. On condition, of course, that the water is hygienically impeccable.

Every individual in a swimming-pool releases dirt and micro-organisms, including potential pathogens, from the body into the water by excretion and water contact. Poorly treated and disinfected swimming-pool water can harbour the risk of communicable diseases, including the resultant economic effects for the general public. It is hence necessary from a hygienic point of view to introduce regulations and requirements in order to minimize health risks for people visiting swimming-pools.

The *Federal Law on Epidemic Control (IfSG)* which came into effect on 1 January 2001 (refer to the 2000 annual report), sets forth hygienic quality standards for water in public swimming-pools. Details will be laid down within the scope of a legal regulation *(Swimming-pool water regulation, SchwBadebwV)* which is yet to be adopted pursuant to section 38, subsection 2 of the Federal Law on Epidemic Control. This regulation is currently being developed by the Federal Ministry for Health (BMG) with the UBA's technical co-operation.

This regulation will set forth the concrete requirements which swimming-pool water must fulfil in order to comply with the Federal Law on Epidemic Control. The microbiological analysis of the swimming-pool water will be the most important criterion for assessing its epidemiological condition and the efficiency of the processing, disinfection and pumping equipment involved in the circulation of pool water. This analysis of the water will be based on the following microbiological hygiene parameters: *escherichia coli (e. coli), legionella species, pseudomonas aeruginosa,* coliform bacteria and colony count.

Microbiological water analyses have the disadvantage that they provide information on the epidemiological condition of water at the time of sampling only. Frequently changing user numbers and hence changing contamination conditions of swimming-pool water would in fact require continuous monitoring of epidemiological parameters. The regulation thus sets forth chemical water quality parameters that can be

continuously measured and recorded in order to permit an assessment of the disinfection status of the pool water. Continuous automatic measurement of these chemical parameters will enable an immediate and indirect, persistent evaluation of the hygienic conditions of swimming-pool water.

The swimming-pool water regulation will also stipulate that the concentration of chemical substances in swimming-pool water may not exceed a level above which human health would be at risk. The legislator will thus define limit values for unwanted by-products of the chlorine-based disinfection process (such as chloramines and trihalogen methanes with their irritating effect and strong odour which cause the typical "swimming-pool odour" which is often incorrectly termed "chlorine smell") as well as for microbiological hygiene parameters. In this effort, the Federal Ministry for Health can use limit values determined by the UBA's scientists.

The regulation provides for tried-and-tested analytical methods for determining microbiological and chemical water quality parameters which were mostly developed during the course of national and international standardization programmes for water analyses. The UBA has been involved in the preparation and quality assurance of a substantial part of the methods within the standardization organizations, i.e. the Deutsches Institut für Normung, the European Committee for Standardization and international standardization organizations (DIN, CEN and ISO).

The regulation will also stipulate that any water treatment processes, including the pertinent chemical substances, which are used to treat the swimming-pool water, must have been approved by the UBA and published in a list in the Bundesgesundheitsblatt (Federal Health Gazette) (refer to part 2, page 128). In order to qualify for inclusion in the UBA's list, processes and the pertinent chemical substances must be effective and free from avoidable or unreasonable effects on health and the environment. They must comply with given purity standards, it must be possible to reliably determine their residual concentrations in swimming-pool water, and they may not be used for any purposes other than those for which they are originally designed.

Apart from water quality requirements, the swimming-pool water regulation also sets forth the following:

- Which hygienic monitoring procedures are to be adopted
- Which co-operation and obligations to tolerate exist on the part of operators of swimming-pools
- Which water analyses operators must perform or have performed
- At which intervals such analyses are to be carried out

The regulation will set forth nation-wide standards for the quality of swimming-pool water, thereby establishing a reliable legal basis for operators and enforcement agencies.

Small bathing ponds: At present, it is not possible from a technical point of view to develop reasonable microbiological water quality standards for small bathing ponds (also termed bio-ponds, swimming-ponds or natural swimming-ponds) and to integrate such standards into the regulation. The small water surface and the small water volume of such ponds lead to a measure of uncertainty with regard to the ecological and hygienic integrity of these small, artificial standing waters.

Small bathing ponds are usually comparable to swimming-pools in terms of their dimensions. Whilst the water of conventional – both outdoor and indoor – swimming-pools is continuously treated and disinfected, small bathing ponds depend on the filtration and self-cleaning capacity of the water in order to reduce microbiological and chemical contaminations to a tolerable degree. Since no chlorine is added to the water of small bathing ponds (because disinfection would have no effect in view of water properties and sedimentation in the pond), these ponds generally pose a risk to health from the UBA's point of view. In summer 2001, for example, the Agency was informed of an increased occurrence of meningitis caused by enterovirus. Qualified virus diagnostics identified bathing in the contaminated water of a small bathing pond as the epidemiological cause of these occurrences. This correlation confirms the UBA's concerns that small bathing ponds are a potential hazard to health.

The microbiological behaviour of small bathing ponds should hence be initially studied over several vegetation periods in order to establish a scientifically reliable data basis for requirements for water quality, design, operation and monitoring. The

UBA's researchers will contribute towards bridging this information gap. *(II 4, II 4.2, II 2.4)*

[29] Further information can be found on the Internet at www.rki.de/GESUND/DATEN/BGSURVEY/BGSURVEY.HTM, www.umweltbundesamt.de/survey/index.htm and www.kinder-jugend-gesundheit21.de. An information hotline on the children's and youths' survey was set up under the German telephone number 01801/75 45 54 21.

[30] A documentation volume summarizing the most important information on contents and proceedings of the forum will be published in mid-2002. Information is available on the Internet at www.forumkinderumweltgesundheit.de.

[31] Guidelines for Community Noise, Birgitta Berglund, Thomas Lindvall, Dietrich H Schwela, World Health Organization 1999.

[32] The system was published on the Internet at www.umweltbundesamt.de, key word: "Daten und Fakten – Bauprodukte" (Facts and Figures – Construction Products), and was also published in "Mitteilungen des Deutschen Instituts für Bautechnik" (Official Gazette of Deutsches Institut für Bautechnik) No. 1/2001.

[33] The final report will be published in the TEXTE series of the Federal Environmental Agency in summer 2002, and will be available from Werbung + Vertrieb (address on page 90).

[34] Verfahren zur Prüfung der Emissionen von Formaldehyd und anderen flüchtigen organischen Verbindungen. (Methods for testing emissions of formaldehyde and other volatile organic compounds). Amts- und Mitteilungsblatt der Bundesanstalt für Materialforschung und -prüfung, Jahrgang 29 (1999), (Official gazette of the Federal Institute for Materials Research and Testing), 29th year of publication, p. 234–250.

[35] "Möbel für gesundes Wohnen? Wie denn? Wo denn? Was denn?" (Furniture for healthy living? How? Where? What). Free copies are available from the UBA's Central Services Unit (address on page 2)

7. A more solid foundation for soil protection

Overview

- Introduction
- Prevention, testing and intervention values
- Limiting pollutants in agricultural soils
- Soil protection information basis
- Data from the long-term soil monitoring programme
- Land recycling
- Contaminated sites and ground-water rehabilitation

Introduction

The *Federal Soil Protection Act (BBodSchG)*, which came into effect in 1999 was the first law to establish a uniform soil protection regime throughout Germany. Soil has since enjoyed the same legal status as water and air. In the interest of the adequate implementation of this act, the Bundesrat announced further need for legislative action in its adoption of the *Federal Soil Protection and Contaminated-sites Ordinance (BBodSchV)*. In its capacity as an expert body, the Advisory Council on Soil Protection (WBB) at the Federal Ministry for the Environment (BMU) additionally recommended fields of action and instruments for preventive soil protection.

The Federal Environmental Agency (UBA) has developed and edited the scientific basis for the prevention of harmful soil changes in order to limit pollutant exposure levels in agricultural soils. The aim is to revise the four ordinances which are relevant in this respect, i.e. the *Sewage Sludge Ordinance,* the *Bio-waste Ordinance,* the *Fertilizer Ordinance* and the *Fertilising-practices Ordinance.*

With these ordinances in place, no further increase in pollutant levels in soils should thus occur with relevance for soil protection.

Another focal issue of soil protection is the definition of soil quality targets. Besides the protection or restoration of soil functions, the quality-related aim of "minimizing soil consumption" deserves more attention.

However, strategies and ordinances are not everything. Making the general public aware of soil as a vital foundation for life is an even more important issue. The establishment of Germany's first Soil Museum in Osnabrück and the publishing of UBA's popular travel guide "Zu den Böden Deutschlands" (To the soils of Germany) (for details, please refer to part 2, page 136) and the establishment of a Soil & Land Alliance of European Cities and Towns are steps in the right direction. But other European nations have also put soil protection on their agendas. The "Soil Protection Communication" of October 2001 presented by the EU Environment Directorate on the occasion of the 2nd European Soil Forum is the EU Commission's first document which exclusively addresses issues of soil protection. The Commission has thus set the frame for soil protection at EU level on this subject. *(II 5)*

Prevention, testing and intervention values

The Federal Soil Protection Act (BBodSchG) and the Federal Soil Protection and Contaminated-sites Ordinance (BBodSchV) have created a nation-wide assessment framework for assessing soil quality for the "Soil-Man", "Soil-Plant" and "Soil-Ground Water" paths of action. The Fraunhofer Institute for Environmental Chemistry and Ecotoxicology, Schmallenberg, Germany, has developed the scientific basis for further prevention values on behalf of UBA.

In a research project on "prevention values and requirements for soils", concentration levels where harmful soil changes are to be expected were identified for 21 substances. These so-called relevance thresholds form the basis from which further soil parameters are derived. One particular focus was on

CMT substances, i.e. substances with a carcinogenic, mutagenic or teratogenic potential.

On behalf of UBA, the Freiburg-based Research and Advisory Institute for Hazardous Substances has developed an ecotoxicological risk assessment for cobalt, chromium (VI), benzene and ethyl benzene as substances relevant for soils and contaminated sites. A draft trigger value document for the "Soil-Man" path (direct path) has been submitted. This document distinguishes between different uses of suspect areas in terms of children's playgrounds, residential areas, parks and leisure areas, as well as industrial and commercial properties.

In order to protect the soil's function as a biosphere for soil organisms, trigger values should also be identified for individual pollutants, so that they can be considered in a future revised version of the Federal Soil Protection and Contaminated-sites Ordinance.

Since a pollutant has a specific effect on different soil functions, the question arises as to which reactions are to be used in order to determine these effects. The following aspects should be generally considered when ecotoxicological action data is to be assessed:

- The test parameters (action criteria) selected must be capable of indicating a disorder condition for central ecological parameters.
- The test parameters should supply an early warning of any short, medium and long-term changes in soil quality.
- The selection should consider both the chemical structure and the principles of action.
- A comprehensive action analysis designed to identify relevant trigger values should combine single-species and multi-species tests, laboratory microcosms, as well as mathematical models and outdoor experiments.

Figure 7 illustrates the concept for defining trigger values for the "Soil-Soil organisms" path. This is the basis upon which trigger values are proposed for the direct path for cadmium, mercury, lead, copper, benzo(a)pyrene and hexachlorocyclohexane (HCH).

(II 5.1)

Limiting pollutants in agricultural soils

In order to ensure the production of healthy food and to protect natural soil functions on a long-term basis, immissions of pollutants into soils must be avoided as far as possible. Food is produced with the help of fertilizers, such as sewage sludge, manure, mineral fertilizers and compost. However, the use of fertilizers means that not just nutrients, but also pollutants access soils. In order to prevent the long-term accumulation of pollutants in soils, the pollutant content of fertilizers should be generally limited as a preventive, permanent measure. The prevention values contemplated in the Federal Soil Protection and Contaminated-sites Ordinance can serve as a yardstick.

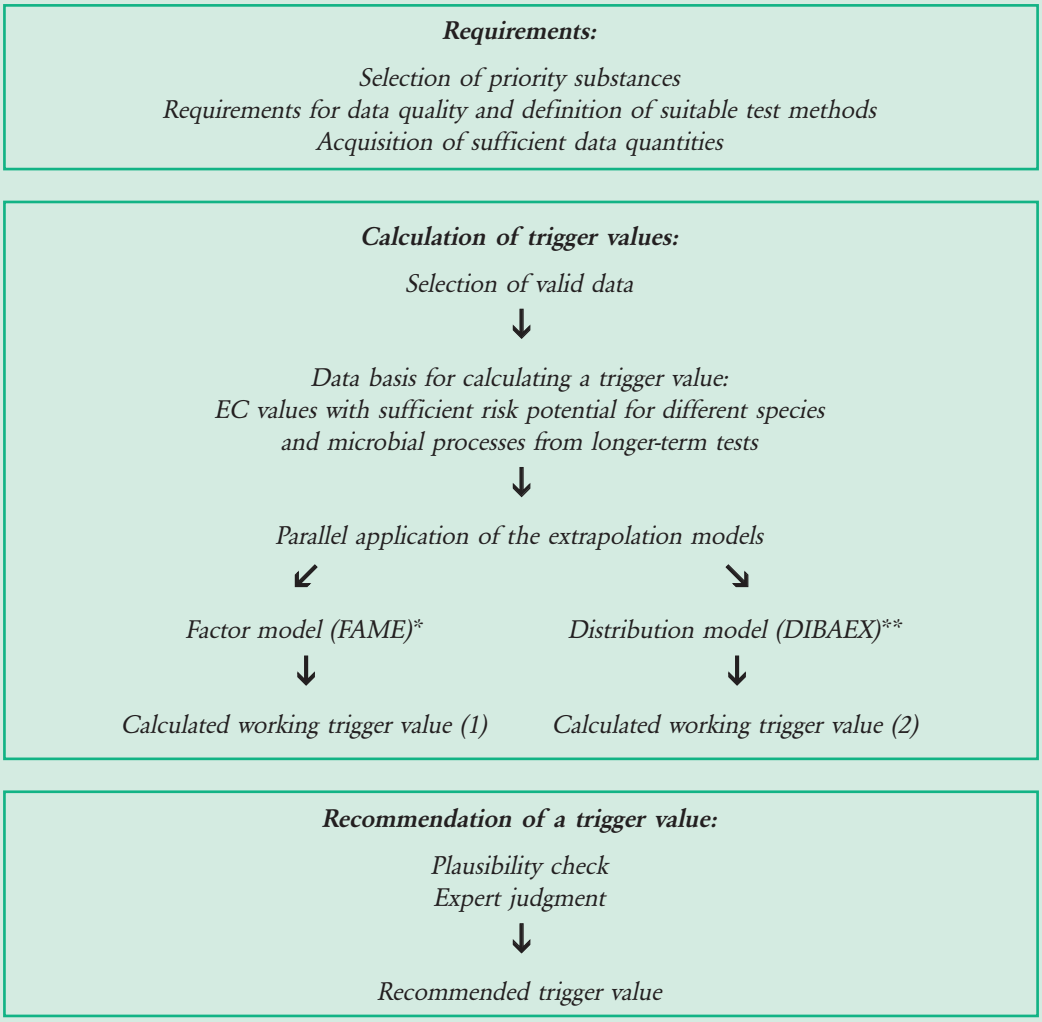
The aim of preventive soil protection is to pursue agricultural methods and processes which avoid pollutant levels at which negative changes in soil functions would have to be expected. This new concept for the use of fertilizers in agriculture is based on four options which reflect the needs of soil as an asset deserving protection:

Option 1: Avoidance of pollutant immissions.
Option 2: Limiting pollutant immissions to a level that corresponds to that of the place where fertilizers are used ("equal to equal").
Option 3: Limiting pollutant immissions to a tolerable, balanced state of immissions and emissions into and from ground water, surface water or foodstuffs ("immission equals emission").
Option 4: Development of conventions on temporarily tolerable accumulation levels and pollutant immissions under defined boundary conditions.

The first three options ensure that pollutant concentrations in soil do not increase further. The fourth option is designed to permit pollutant accumulations up to a certain (harmless) concentration level in the soil. It is based on the assumption that technical measures are in place in order to reduce immissions to the levels contemplated in options 2 or 3 before critical soil concentration levels are reached. Anything else would conflict with the principle of sustainability in the long run.

UBA has published principles and measures for the implementation of these options [36]. These principles and measures should apply to all kinds of fertilizers used in agriculture, and should be made part of both national and EU legislation. The principles reflect the joint position of the Federal Ministry for the Environment (BMU) and UBA of 7 June 2001. They also form the basis for the resolutions by the Joint Conference of Ministers for the Environment and for

Figure 7: Concept for trigger values for the "Soil-Soil organisms" path of action



* FAME = factorial application method
** DIBAEX = distribution based extrapolation

Agriculture (UMK/AMK) of June 2001. The concept was presented to the expert public at a two-day symposium on "Agricultural use of sewage sludge, manure and other fertilizers, taking environmental and consumer protection interests into consideration" organized by the Federal Ministry for the Environment and the Federal Ministry for Consumer Protection (BMVEL) on 25 and 26 October 2001 in Bonn.

The concept demonstrated that critical soil concentration levels can be reached within a relatively short period of time, depending on the degree of historical soil pollution. The implementation of the first three options hence requires prompt action.

The aim is thus clear. Current pollutant concentrations in soils may not rise further. In the case of organic fertilizers, this can be best-achieved with the "equal to equal" approach. The reference parameter must be the share of fertilizers remaining in the soil on a long-term basis. This option is already set forth in the *EC Regulation on Organic Production of Agricultural Products (Regulation 2092/91/EEC, as amended by Regulation 2381/94/EEC* on compost) as well as in the Federal Soil Protection and Contam-

inated-sites Ordinance (for materials to be applied to and immitted into soils) with regard to the limitation of pollutants in the materials concerned. This suggests that this principle can be easily applied to the evaluation of bio-waste in conventional agriculture. *(III 5.2)*

Data from the long-term soil monitoring programme

Reliable data on the condition of soils is a precondition for substantiated soil protection decisions and for defining priorities, both in the Federal states and at a nation-wide level.

The Federal states have set up some 800 permanent soil monitoring sites in order to gather information on the condition of soils. The permanent soil monitoring programme uses data on different parameters as a basis for preventive soil protection, including data on:

- Soil geography (data on substrate and/or parent material)
- Soil condition (material and structural soil characteristics with a view to nutrients and pollutants)
- Development of and change in soil condition over the course of time

This data makes it possible to issue statements on the exposure potential of soils and forecasts of future developments.

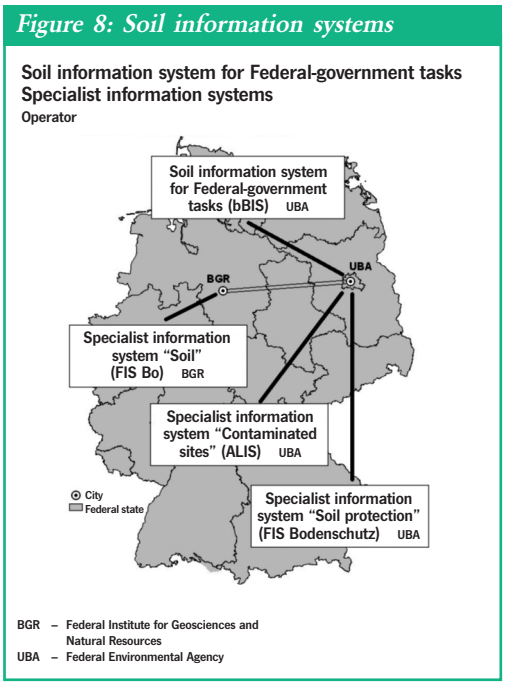
The data from the permanent soil monitoring programme available to the Federal governments should also be used at a nation-wide level. For this purpose, the Freiburg-based "Büro für Boden und Geologie solum" has compiled an overview of what is being monitored and where. [37].

This compilation of meta data is included in the bBIS soil information system already described in this report. It enables the central supply of information for different projects to be implemented nation-wide. The parameters examined at the different sites are described there (for example, soil biology and soil water studies). This enables the use of synergies and strengthens co-operation between Federal and Federal-state government. The nation-wide compilation of data from the Federal states on specific issues also supports Federal-state governments when it comes to further-perfecting and comparing their data acquisition and analysis methods. What's more, Germany's permanent soil monitoring programme can also be integrated into the environment monitoring effort on a European level. *(II 5.2)*

Information basis for soil protection

The bBIS soil information system is being developed by UBA. This computerized instrument links the three soil-related technical information systems together, i.e. the "pedology" information system of the Federal Institute for Geosciences and Natural Resources (BGR), the "contaminated sites" information system (ALIS) and the "soil protection" information system (both run by UBA) (Figure 8).

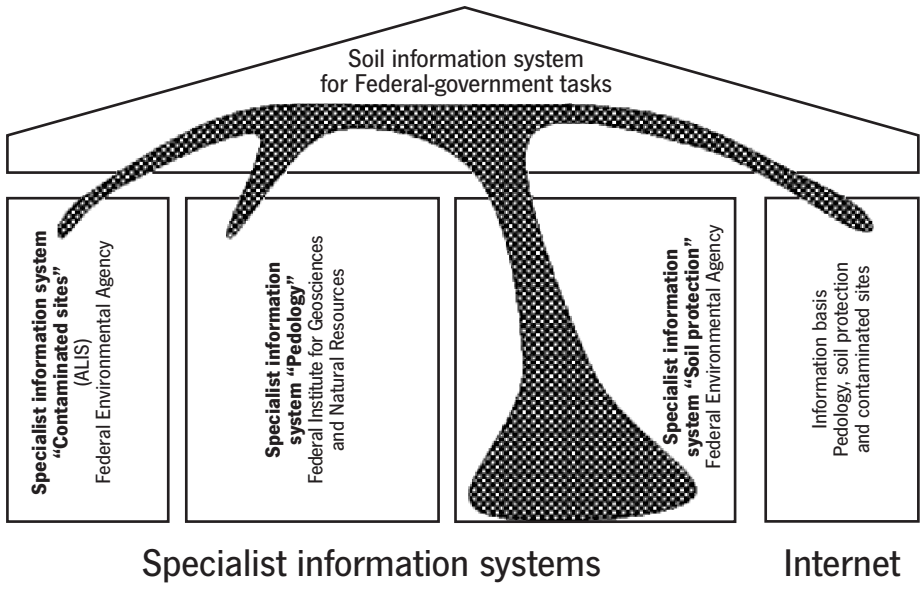
Figure 8: Soil information systems



In 2001, Beak Consultants, Freiberg, developed the "basic architecture" of the bBIS. An object-orientated database was developed within the scope of the second sub-project, i.e. the system development. Important parts of the "soil protection" information systems are thus in place (Figure 9).

The "palm-tree" represents the completion status of the bBIS. In the pillar model, it covers part of the "pillars" and of the "roof". This area symbolizes the respective completion shares of the bBIS. The connections from the "roof" of the bBIS refer to the use of comparable key lists, largely identical databases and

Figure 9: Pillar model of the bBIS with "palm-tree" = completed components



potential interfaces in the relevant parts of the systems and hence in the different public authorities.

One central aim of the development was – apart from the general implementation of the data model for the entire system – to gather meta data from the practical operation of permanent soil monitoring areas.

The database of the "soil protection" information system contains a host of modules in which the most varied data on pedology and soil protection data can be stored (primary data, secondary data, pedological data).

The "meta data" module of the permanent soil monitoring project enables the gathering and editing of meta information on data gathered at the permanent monitoring areas in Germany. This meta data provides information as to whether and, if so, which parameters are measured at the individual permanent soil monitoring areas and which processes are used to this effect. *(II 5.2)*

Land recycling

In 2001, around 130 hectares (ha) of soil per day were newly developed for settlement and transport purposes in Germany. This corresponds to 200 football pitches per day or the area of the city of Bremen every year. Another increase of 500,000 hectares is expected by the year 2010, an area twice as large as the Saarland. In Germany, the additional land use is to be reduced to 30 hectares a day by the year 2010. A research project by UBA shows that derelict sites measuring around 128,000 hectares are at the same time available for urban development in Germany (refer to the 2000 annual report). It is hence of paramount importance that these derelict sites be developed and re-used – i.e. recycled – in order to reduce the pace of land use. Land recycling builds on the aims and the concept of sustainable, i.e. permanently environment-compatible, development.

The results of a work group on land recycling chaired by UBA within the scope of the European CLARINET (**C**ontaminated **La**nd **R**ehabilitation **N**etwork for **E**nvironmental **T**echnologies in Europe) research project show that land recycling is an important issue throughout Europe. Although coal mining and steel processing nations – such as Germany, France and the UK – are particularly affected, land recycling is generally important wherever economic activities are concentrated in specific areas. It was generally found for all of Europe that the array of interactions between environmental protection, planning and economic interests, legislation and political significance plays a central role in the success and effectiveness of land

recycling efforts. The CLARINET was successfully concluded in June 2001 [38].

Experience with concrete projects in Europe shows that target-orientated co-operation between environmental and planning authorities as well as business promotion institutions can help to make abandoned sites available for consecutive uses. The CLARINET work group has, however, identified a pan-European shortcoming: the different disciplines involved show a reluctance to pursue an inter-disciplinary approach. This holds true for co-operation between technical experts in the field of land rehabilitation, urban planners and urban development authorities at a practical level, as well as inter-disciplinary co-operation between engineers, regional planners, the business community and lawyers at the direct project level.

Integration and co-operation at the political, as well as the administrative and project levels are still underdeveloped in most European countries. The recommendations for future research developed by the work group specifically address this interdisciplinary and integrated approach:

- Political strategies and programmes in order to avoid derelict sites and to provide concrete data on derelict sites in future
- Re-use and planning for successive uses and flexible project development in line with urban development requirements
- Land rehabilitation and technical processes using innovative technologies, far-reaching use of existing buildings and infrastructures and optimised rehabilitation strategies
- Economic efficiency thanks to uncompromising cost analysis, protection against financial risks and the development of systematic cost structures

In order to provide the necessary research capacity, the work group also proposed that the EU Commission promote an interdisciplinary scientific network for land recycling. This network started its work during the first half of 2002. The network is co-ordinated by the University of Nottingham in the UK and UBA.

(II 5.3)

Contaminated sites and ground-water rehabilitation

Measures must be taken in order to ward off the dangers caused by contaminated areas when there is an imminent or existing risk to ground water. Contaminated ground water itself means further risks for the resources located within ground-water flows. Extended ground-water contamination, in particular, in industrial core regions, usually means that the polluted ground water or the ground-water saturated soil zones themselves must be considered as causes of hazard in their own right. Irrespective of measures aimed at preventing further pollutant emissions from the soil into the ground water, further action is then necessary in order to avoid risks to other resources in the area that are influenced by the ground water.

Rehabilitation of contaminated ground water can be both a measure to ward off hazards and a measure to prevent water pollution. The Federal Soil Protection Act leaves it to water law to set forth the ways in which rehabilitation is to be carried out. Practical experience shows that it is not always possible to correctly forecast feasibility, success and reasonableness of measures. It was not possible to adequately identify or consider parameters that were relevant for rehabilitation programmes. It is hence not possible to achieve the trigger values with the rehabilitation measures currently available, or at best at a very high cost.

In order to improve this situation, a joint project of Federal and Federal-state governments on “criteria for ground-water rehabilitation” was launched with UBA playing a major role in this effort.

A retrospect approach is initially adopted in order to document past ground-water rehabilitation projects in a database. The subsequent evaluation aims to identify generalized features which describe the efficiency of rehabilitation measures, even with the help of additional potential analyses and forecasting approaches towards burden assessments.

Furthermore, a technical and legal foundation is to be created for developing a nation-wide concept for tackling ground-water pollution.

In this context, proposals are also to be developed with regard to the implementation of the EU Framework Directive on Water Policy (refer to chapter 8) concerning the definition of situations where rehabilitation is necessary, as well as with regard to qualitative criteria for the definition of protection aims and protection levels in detail within the scope of the discretionary powers which exist on a case-specific ba-

sis. The recommendations will focus on a number of aspects, including the following:

- Recommendations for exploration and suitability studies before rehabilitation
- Evaluation aids and criteria for defining rehabilitation aims on the basis of hydrogeological and technological boundary conditions
- Identification of requirements for planning, implementation and monitoring of ground-water rehabilitation measures (quality assurance, monitoring)
- Catalogue of criteria for the conclusion of an (active) ground-water rehabilitation measure

This is to be followed by the evaluation of legal criteria in order to orientate ground-water rehabilitation projects more than ever before towards success, economic adequacy and general European water legislation.

(II 5.3)

[36] Grundsätze und Maßnahmen für eine vorsorgeorientierte Begrenzung von Schadstoffeinträgen in landbaulich genutze Böden (TEXTE 59/01) (Principles and measures for the prevention-orientated limitation of pollutant immissions into agricultural soils), available from Werbung + Vertrieb (address on page 90).

[37] Möglichkeiten der länderübergreifenden Auswertung an Standorten der Borden-Dauerbeobachtung (TEXTE 22/01)(Options for a nation-wide evaluation at sites subject to permanent soil monitoring), available from Werbung + Vertrieb

[38] The final report is available on the Internet at www.clarinet.at. The final report of the "Land recycling" work group is available at www.umweltbundesamt.de/altlast/web1/start.htm.

8. A fluid transition: new water policy in Germany

Overview

- Introduction
- Pollution and its effects
- Heavily modified waters
- Reference conditions and class limits
- Inland waters, coastal waters and transitional waters
- Economic analysis
- Draft ground water daughter directive
- Priority substances

Introduction

The new *EU Framework Directive on Water Policy* was published in the Official Journal of the EU on 22 December 2000. This marked the beginning of the three-year period for implementing the directive in national law. The EU Framework Directive on Water policy demands far-reaching modification and expansion of water management, for example, in the following areas: basin approach, strengthening of the immission approach and its linking to the emission approach, economic analysis, integration of ground water into management plans, limitation or discontinuation of emissions of "priority" or "priority hazardous" substances, as well as intensification of ecological quality assessment. These key words alone already show that the implementation of the EU Framework Directive on Water Policy will require a lot of methodological and technical preparation.

The implementation process is accompanied and co-ordinated by the EU Commission. So-called advisory expert groups were set up in order to develop the necessary EU daughter guidelines, for example, on limiting priority substances, on ground-water protection and on reporting. Ten strategy groups are to develop guidelines to support harmonised implementation throughout the EU (Figure 10, page 60).

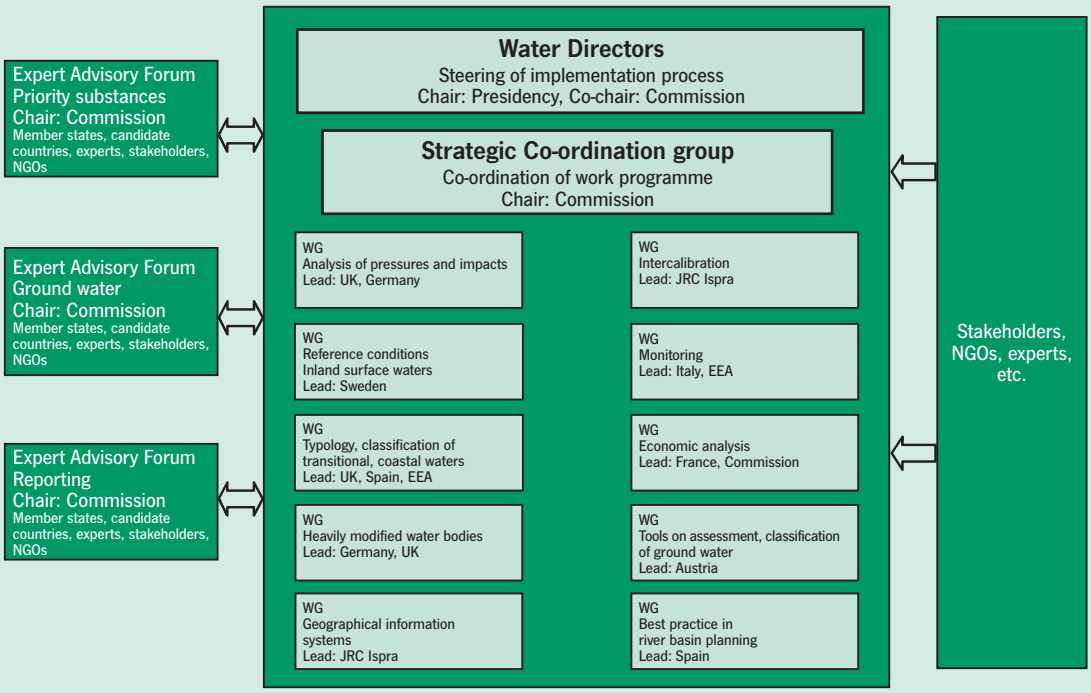
The Federal Environmental Agency (UBA) is particularly active in those fields where scientific/technical or economic methods are the focus of interest. The aim is to develop technically reliable concepts that can be realistically implemented at a reasonable cost. This work is carried out in close co-operation with the committees of Länderarbeitsgemeinschaft Wasser (LAWA). The initial main issue is a characterisation of river basins.

Analysis of pollution and its effects

One of the first tasks to be tackled by Europe's water management authorities when it comes to the implementation of the EU Framework Directive on Water Policy will be to analyse the repercussions of human activity on the condition of surface waters and ground water. This is expected to be completed by the end of 2004. One precondition for comparable measures at EU member state level will be a joint understanding of what "significant pollution" is, i.e. the answer to the question whether this pollution will jeopardize the aim of a "good condition". The EU IMPRESS (**Imp**act and **Press**ures) work group started its work in October 2001 on these issues. This group is jointly managed by UBA and the Environment Agency for England and Wales. It was prepared in June 2001 by a German-British workshop in which eight member states participated. A survey was conducted in order to identify the approaches of the different member states.

The definition of the term "water pollution" in the EU Framework Directive on Water Policy goes beyond earlier definitions. With a view to a good ecological condition, not just material pollution of waters, but also anthropogenic changes (caused by human intervention) in water volumes, flowing conditions and structures of river beds and water environments must be taken into consideration. Specifications of the scope of the required studies can only be found in older water protection directives for pollutant emissions from point sources and diffuse sources. Another problem is the fact that the biological criteria for

Figure 10: Community strategy for implementing the EU framework directive on water policy



a good ecological condition have not yet been defined in detail, all the more so since they are likely to differ from case to case, depending on the type of water and natural conditions. Notwithstanding this, the directive will have to rely largely on available data for an analysis of human activities in order to remain manageable by enforcement agencies. UBA has commissioned a research project in order to support this work and, together with researchers at Kassel University where this project is being carried out, has submitted a first pragmatic proposal for discussion. The work group must complete its assignment by the end of 2002 in order to make the results available as a basis for practical work.

Heavily modified waters

The general aim of the EU Framework Directive on Water Policy is to achieve a good ecological and chemical condition of surface waters and to prevent deterioration of the situation at an EU level. However, certain exceptions are allowed both in terms of the relevant deadlines and the requirements themselves. In the case of artificial and heavily modified waters with the less demanding water protection aim of a "good ecological potential", there were two main reasons for the introduction of exceptions: Firstly, the typical natural condition cannot be used as a reference scale for artificial waters, and, secondly, there was a general concern that the good ecological conditions of several waters could be achieved only on condition that their use was discontinued.

As far as "heavily modified waters" are concerned, the EU Framework Directive on Water Policy thus provides that the ecological assessment and the resultant plans of action be orientated towards the "maximum ecological potential" rather than the reference condition. Since the end of 1999, the HMWB (Heavily Modified Water Bodies) work group which is jointly managed by UBA and the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER) and the Environment Agency for England and Wales has been responsible for defining the criteria in more detail which are used to classify waters as "heavily modified". This is carried out on the basis of 31 case studies of flowing waters, lakes, estuaries and coastal waters in twelve European countries, including three UBA-financed case studies of one large, one medium-sized and one small flowing water with different uses (navigation, water power, agriculture, flood protection).

These case studies are being carried out under jointly defined boundary conditions which are laid down in twelve subject-related papers (including, for example, on the strategy for classification procedures, on the list of hydromorphological intervention and assignment to uses – such as navigation or water power, on economic analysis and on the identification of the ecological potential). The member states finance these case studies (project phase 1), whilst the EU Commission provides the funds for their synthesis (project phase 2). The subject-related papers and the results of the case studies form the basis for a guideline which is expected to be available at the end of 2002.

The evaluation of the ecological condition of waters pursuant to the EU Framework Directive on Water Policy is orientated towards a so-called reference condition, i.e. a condition where no or only minor anthropogenic intervention and influences exist and where the communities of species typical for the respective waters are unaffected. On this basis, waters are divided into five categories. Class I corresponds to the condition mostly free from anthropogenic influences (high water quality), whilst class II corresponds to the quality target of the EU framework directive on water policy (good water quality).

The "REFCOND" (**Ref**erence **Cond**itions and Ecological Classification) work group is developing criteria for the definition of reference conditions and for the definition of uniform categories within the five-stage assessment system for flowing waters and lakes on a pan-European level in order to ensure the comparability of results throughout Europe. The work group under Swedish management commenced its work in December 2000. This work is scheduled to be completed by October 2002.

Inland waters, coastal waters and transitional waters

The biological assessment of waters pursuant to the EU Framework Directive on Water Policy is orientated towards the communities typical for the natural area as the yardstick of evaluation. The five-stage ecological classification of flowing waters and lakes is based on the systematic analysis of phytoplankton, water flora, benthic invertebrates and fish fauna. In Germany, no methods or processes that meet with the requirements for an ecological assessment of inland waters according to the criteria and specifications of the directive are yet in place. Substantial research efforts will be needed in order to develop suitable methods. UBA is sponsoring two projects for the example-orientated biological evaluation of flowing waters on the basis of macrozoobethos, a method which is also planned to replace the saprobia system that has been used up to now. Further studies for developing evaluation systems for water flora (macrophytes, phytobenthos), phytoplankton and fish fauna are being financed by Länderarbeitsgemeinschaft Wasser (LAWA) and the Federal Ministry of Education and Research (BMBF).

Besides biology, the physical and chemical condition of waters in the different types of water is another important aspect for implementing the EU Framework Directive on Water Policy. These are currently the subject of investigation by another UBA project.

The EU Framework Directive on Water Policy also stipulates that the effects of human activity on the chemical condition of surface water must be examined. Several studies are designed to identify significant anthropogenic burdens and potential hazards for the good quality of waters.

Another work group was set up in order to examine the specific issues of coastal and transitional waters. This group is managed by the UK with the co-operation of Germany, France, Sweden and the European Environment Agency (EEA). The work group's field of work includes, for example:

- A guideline for a typology of waters (Germany)
- A guideline for the identification of water bodies (Sweden)
- A guideline for the definition of reference conditions for waters (UK)
- An overview of existing evaluation concepts and identification of methods for classifying biological and chemical quality (EEA).

The guidelines are scheduled to be mature for adoption by June 2002.

Germany has developed a draft typology that has been harmonized at a national level and will form the basis of further consultation. During the course of ongoing co-operation at EU level, Germany will play an active role in developing guidelines for the classification of transitional and coastal waters. An important basis for this are region-specific background parameters and reference values for the relevant biological

and chemical parameters. Plans exist to adapt the concept for evaluating eutrophication that was developed under the general responsibility of the Netherlands and Germany within the scope of the *Oslo-Paris Convention for the Protection of the North-East Atlantic (OSPAR)*.

Once a classification concept is in place and reference areas identified for the different types of German transitional and coastal waters, the existing measuring programme of the Federal and Federal-state governments for monitoring the North Sea and the Baltic Sea (BLMP) will be optimized and adapted. This measuring programme so far focuses on the monitoring requirements pursuant to the Convention for the Protection of the Baltic Sea (HELCOM with the COMBINE measuring programme) and the North East Atlantic (OSPAR with the JAMP measuring programme). Although many measuring parameters correspond to those of the EU Framework Directive on Water Policy, so that specific parameters only require an adaptation of measuring network and measuring frequencies, other parameters are completely new. This does, in particular, apply to the so-called "hazardous substances" which correspond only in part to the OSPAR and HELCOM lists. Against the background of increasing demands and stagnant capacity, the measuring programme of the Federal and Federal-state governments for monitoring the North Sea and the Baltic Sea (BLMP) must be optimized in such a manner that not just the statutory requirements of the EU Framework Directive on Water Policy, but also the requirements of other measuring programmes which have been agreed to at an international level, can be met with.

Economic analysis

The EU Framework Directive on Water Policy is one of the EU's first environmental directives which systematically uses economic concepts in order to achieve its aims. In this respect, the directive relies on a number of important principles, i.e.:

- the principle of recovering costs, including environmental and resource costs ("all costs must be recovered") and
- the polluter-pays principle.

Integrating economic elements into water management is not a purpose in its own right, but reflects the understanding that economic factors need to be considered in order to achieve the aims of water protection and that the most economical instruments are required to this end.

Economic requirements are to be found in the directive at several points. These requirements are linked both to each other and to other requirements. Three areas, which are subject to different time horizons, are important, i.e.:

- the economic analysis of water uses
- water prices which cover the real costs (including environmental and resource costs)
- the justification of exceptions and the identification of heavily modified waters.

The economic analysis includes an economic stocktaking of water uses and must be concluded by the end of 2004. The justification of exceptions and the identification of heavily modified waters must form part of the management plan which must be completed by 2009. All the member states are obliged to introduce cost-recovering prices by the year 2010, however, with certain exceptions being possible.

This means that the economic analysis is in the focus of interest. With a view to recovering the real costs of water-related services, two questions arise: First of all: Will the users pay the costs of water supply and waste water treatment, or will subsidies be granted? The second question must be answered under economic welfare aspects, i.e. whether consumers will in fact pay all the costs actually caused by them (i.e. not just the financial costs of water supply companies, but also the resultant environmental and resource costs). Furthermore, the economic analysis should also compile information which permits the assessment of the costs of individual measures and of the most cost-effective combinations of measures.

The background for this requirement is that measures must be taken in order to improve water bodies which are not in a good condition, so that a good condition is achieved for these waters by the year 2015 (unless exceptional treatment is granted).

It is obvious that this assessment will be of a more orientating nature because the real programme of measures does not have to be set up until 2009. It does, however, make sense to make some general considerations at an early stage as to how a good condition can be achieved by making optimum use of the means available.

The Länderarbeitsgemeinschaft Wasser (LAWA) is in the process of developing a work tool for the practical implementation of the EU Framework Directive on Water Policy [39]. This work tool is to provide an easily understandable description of the EU Framework Directive on Water Policy for its implementation, to ensure a harmonized approach towards implementation, and to avoid parallel work. In a research project accompanied by UBA, a draft guideline for economic analysis was developed in 2001 together with the "Environmental Economics" subcommittee of LAWA and presented to the expert public during a workshop. This draft has meanwhile been integrated into the LAWA work tool. Furthermore, the Federal Ministry for the Environment, UBA and LAWA were represented in the European WATECO (**Wat**er Framework Directive **Eco**nomics) work group which is developing a guideline for economic analysis that is scheduled for completion by mid-2002.

Draft EU ground water daughter directive

The aim of the "good condition" according to the EU Framework Directive on Water Policy has yet to be defined in more detail. Article 17 demands that the Commission present the strategies necessary to prevent and limit ground-water pollution in an *EU Ground Water Daughter Directive* by the end of 2002. This project focuses on the following issues:

- Criteria for assessing a good chemical condition of ground water
- Interpretation and description of the ground-water condition
- Criteria for determining significant and persistent pollutant trends
- Starting point for reversing the trend

In November 2001, the "Advisory Expert Group on Ground Water" was set up in order to make the preparations and organise the discussions necessary to prepare the first draft in summer 2002.

UBA and the Federal states are participating in this discussion and contributing experience from Germany. This includes preparatory work on the typification of ground-water bodies and on defining background values, indication parameters for typical ground-water pollutions, development of quality standards for ground water, geographical integration of

Table 3: List of priority substances pursuant to the EU Framework Directive on Water Policy

(1)	*Alachlor*
(2)	*Anthracene***
(3)	*Atrazine***
(4)	*Benzene*
(5)	*Brominated diphenylethers**
(6)	*Cadmium and its compounds**
(7)	*C_{10-13} chloroalkanes**
(8)	*Chlorfenvinphos*
(9)	*Chlorpyrifos***
(10)	*1,2-Dichloroethane*
(11)	*Dichloromethane*
(12)	*Di(2-ethylhexyl)phthalate (DEHP)***
(13)	*Diuron***
(14)	*Endosulfan*** *(alpha-endosulfan)*
(15)	*Fluoranthene*
(16)	*Hexachlorobenzene**
(17)	*Hexachlorobutadiene**
(18)	*Hexachlorocyclohexane** *(gamma-isomer, Lindane)*
(19)	*Isoproturon***
(20)	*Lead and its compounds***
(21)	*Mercury and its compounds**
(22)	*Naphthalene***
(23)	*Nickel and its compounds*
(24)	*Nonylphenols** *(4-(para)-nonylphenol)*
(25)	*Octylphenols*** *(para-tert. octylphenol)*
(26)	*Pentachlorobenzene**
(27)	*Pentachlorophenol***
(28)	*Polyaromatic hydrocarbons (PAHs)** *(Benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene)*
(29)	*Simazine***
(30)	*Tributyltin compounds** *(tributyltin-cation)*
(31)	*Trichlorobenzenes*** *(1,2,4-trichlorobenzene)*
(32)	*Trichloromethane (chloroform)*
(33)	*Trifluraline***

* *Priority hazardous substance*
** *Priority hazardous substance for review*

monitoring data for evaluation, as well as a description of the condition of ground water.

Priority substances

Decision 2455/2001/EC establishing the list of priority substances of 20 November 2001 contains 33 substances and substance groups (Table 3, page 63). 11 of these substances were classified as "priority hazardous substances" which means that pursuant to article 16(3) of the EU Framework Directive on Water Policy the immissions, emissions and losses of such substances must be discontinued within a maximum period of 20 years following the coming into effect of the directive. Another 14 substances must be examined by the Commission during the course of the year 2002 as to whether such substances are "priority hazardous" or (just) "priority" substances.

Pursuant to articles 16 (7) and 16 (8) of the EU Framework Directive on Water Policy, the EU Commission must as a minimum measure, within two years after a substance has been entered in the list of priority substances, submit proposals for limiting emissions from point sources as well as proposals for quality standards for concentrations of priority substances in surface waters, sediments or biota.

The quality standards are the measure for the good chemical condition. When the quality standard for just a single priority substance is exceeded, this means that the chemical condition of the affected water is no longer rated as being good.

With regard to the limitation of priority-substance emissions, UBA is managing a project on "Determining the sources of priority substances within the scope of article 16 of the EU Framework Directive on Water Policy in order to estimate immission volumes in Germany". The Fraunhofer-Institut für Systemtechnik und Innovationsforschung, Karlsruhe, Germany, focuses on the most important immissions and immission paths in this context.

Measures for substances on the list of priority substances – i.e. industry chemicals, plant protection agents and biocides – also concern the relevant EU approval guidelines. A clear differentiation between the different regulations is, however, still pending.

(II 3.2)

[39] The latest version of the work tool is available on the Internet at www.lawa.de.

9. Product-related environmental protection

Overview

- Introduction: the principle of product responsibility
- Packaging
- Old electrical appliances
- Batteries
- Old vehicles
- Product responsibility and integrated product policy
- „Blue Eco-Angel“ and the „EU Flower“ – reliable emblems for consumers

Introduction: the principle of product responsibility

Product-related environmental protection aims to reduce the harmful effects that products have over their entire lifecycle on the environment. This means that all the phases of product life – from production via use to disposal – must be taken into consideration. The issue is, in a nutshell, environment-compatible regulations and standards for production, use and disposal.

Since 1972, German waste legislation and German waste management practice have moved in central areas from a disposal-orientated system to the concept of re-use and recycling. The 1986 *Waste Act (AbfG)* introduced the requirement of re-use as far as this is technically possible and economically reasonable. This act made it possible to oblige manufacturers to mark, separate and take back their products at the end of their useful life. The best-known application of this obligation is currently the *Packaging Ordinance (VerpackV)* and the establishment of the so-called “Dual System” (“Green Dot” and “Yellow Bag”).

The 1994 *Recycling and Waste Act (KrW/AbfG)* made “recycling” and “product responsibility” key words of waste policy. The waste industry and waste management were orientated even more towards products and their environmental effects. This was also the legal basis on which the *Battery Ordinance* came into effect in 1998. The Old Vehicles Act was enacted in spring, and came into force in July 2002. An *Ordinance for Old Electrical Appliances* is in preparation. The product ordinances on batteries and old vehicles implement the *EEC Battery Directive (Council Directive 91/157/EEC on Batteries and Accumulators Containing Certain Dangerous Substances)* and the *EC Old-Vehicles Directive (Directive 2000/53/EC on End-of Life Vehicles)* in German law.

Products – packaging materials, batteries, vehicles, electrical appliances and electronic devices – have many different properties. This concerns, for example, their useful life, their pollutant content, product diversity and complexity and hence their recycling capability. Each product group hence requires specific regulations and procedures. All the new obligations to take back products transfer not just the legal, but also the financial responsibility to the manufacturers, at least to some extent. Consumers can return end-of-life products for free. Retailers are integrated in the collection logistics for used products. The EU, for example, has plans for a legislation designed to oblige retailers to take back old electrical appliances on a “one-to-one!” basis. This means that customers buying a new appliance can return a corresponding old appliance at no cost. Furthermore, the regulations also set forth qualitative and quantitative targets for collection and recycling.

Packaging

Thanks to the packaging ordinance (see box on page 67), consumption of packaging materials in Germany declined from an annual 15 million tonnes to less than 14 million tonnes in the 1990s, despite increasing consumption. This was achieved by a general “slimming down” of packaging (doing without unnecessary packaging, reducing material thickness). However, packaging material also has a protective function, so that these attempts to avoid waste are

strongly restricted. As a result of this, consumption of packaging materials has been increasing again since 1998. In 1999, the figure was in the order of 14.6 million tonnes of which 11.7 million tonnes (805) were recycled within the scope of the packaging ordinance.

Re-usable packaging on the decline: Attempts to support the exemplarily high share of re-usable packaging were less successful. The first packaging ordinance from 1991 stipulated a minimum rate of 72 % below which the government would intervene. Statistical surveys conducted on behalf of UBA by Gesellschaft für Verpackungsmarktforschung (GVM) show that the actual values have once again been lower than this since 1997. Re-usable packaging is increasingly being replaced by one-way packaging. In 2000, the rate of re-usable packaging was as low as 65.6 %, with values close to 60 % being expected for 2001. Declining rates of re-usable packaging mean that deposits will become mandatory as of 1 January 2003 as provided for in the 1991 packaging ordinance.

The debate on the ecological evaluation of beverage packaging was strongly influenced by the results of the eco-balances conducted by UBA in this respect. The very differentiated individual statements show that the waste aspect is just one facet of an evaluation of the different types of packaging materials. An environmental-impact comparison of different packaging types requires an integrated analysis of a host of environmental effects, such as the greenhouse effect, acidification, eutrophication, human and ecotoxic effects within the scope of an integrated ecological burden assessment. UBA has made important methodological and technical contributions towards this issue and will continue to work on further methodological optimization.

The German packaging ordinance was in many respects a model for the *EU Directive on Packaging (Packaging Directive 94/62/EC)* that was adopted at the end of 1994. The German regulations thus required only minor adaptation when the packaging ordinance was revised in 1998.

One important element of the guideline is the definition of minimum recycling rates for packaging materials. During the first five-year term until 2001, member states have to achieve a minimum recycling rate of 15 % for packaging made of glass, metal, paper/cardboard and plastic, and of 25 to 45 % for all packaging materials together. A total recycling rate of 50 to 65 % is aimed at, including energy recovery and biological recycling processes. The EU Commission has proposed more restrictive recycling targets for the second five-year term until 2006. Recycling rates will differ from material to material, for example, 60 % for glass, 55 % for paper and cardboard, 50 % for metals and 20 % for plastic. A material recycling rate of 55 to 70 % is aimed at for all packaging materials and a total recycling rate (i.e. including energy recovery and biological recycling) of 60 to 75 %.

Prospects: The increased percentages proposed by the Commission are generally a step in the right direction. Current negotiations should, however, also aim at eliminating upper limits for recycling which do not make much sense. Furthermore, the proposal of treating material recycling and chemical recycling of plastic alike is rejected. It is expected that the new proposals will be implemented *in the short term*. *In the medium term*, the EC Packaging Directive will require a more in-depth revision, in particular, with a view to existing problems in defining the conformity requirements for packaging materials in more detail within the scope of the "new approach".

Old electrical appliances

Every year, private households and businesses in Germany produce some two million tonnes of electrical appliances and electronic scrap. These quantities are likely to increase in future, for example, as a result of ever-shorter service life spans of appliances. In order to protect raw material resources, these materials must be recycled, and appliances and components must be re-used.

The Federal government originally planned to adopt regulations for information, office and communication technology equipment, and presented a *Draft Ordinance for End-of-life IT devices (ITV)* on the basis of the Recycling and Waste Act in 1998. The environmental committee of the Bundesrat proposed to amend the ordinance to include entertainment and large domestic appliances *(Ordinance for End-of-life Electrical Appliances, EAV)*.

In June 2000, the EU Commission presented its proposals for an *EU Directive on Waste Electrical and Electronic Equipment* and for a *Directive on the Restriction of the Use of Certain Hazardous Substances*

Requirements of the packaging ordinance

Waste avoidance

- Packaging volume and dimensions/weight must be reduced to a minimum.
- Re-use should be aimed at, with a minimum share of 72 % for beverage packaging.
- The contents of heavy metals, i.e. lead, cadmium, mercury and chromium (VI) in packaging material may not exceed a total of 100 parts per million (ppm).
- Higher heavy-metal contents caused by recycling processes are only permitted for plastic and glass packaging under certain boundary conditions.

Waste recycling

- Packaging must be taken back and recycled by manufacturers and retailers as far as this is technically possible and economically reasonable.
- Packaging materials from households and small businesses (accounting for roughly half the total packaging volume) are additionally subject to minimum recycling rates: 75 % for glass packaging, 70 % for tinplate, 60 % for aluminium, 70 % for paper and cardboard and 60 % for composite materials.

These targets can be achieved either by retailer participation (disposing of packaging materials by retailers), i.e. taking back packaging materials at the point of sales, or by participation in regional or nation-wide systems by collecting packaging materials at the consumers' homes.

in Electrical and Electronic Equipment [40]. On 4 December 2001, the Council adopted the joint standpoint under Belgian presidency [41] (see box on page 68).

The joint standpoint was submitted to the European Parliament in December. The Parliament has discussed the guidelines in the second reading. The adoption of the guideline is expected before the end of 2002. It must be implemented in German law within 18 months.

The directives will greatly enhance the disposal situation for old appliances in the EU. UBA has drafted a number of comments, for example, on various controversial issues (substance flow quota versus category-related quota, treatment requirements for flat displays (LCD technology) as well as printed circuit boards), advocated an amendment to the directives to include photo-voltaic installations, and intensively supported the consultations within the Council's work group on the environment. Since the EU Directive on Waste Electrical and Electronic Equipment proposes re-use and recycling rates for the ten equipment categories which will be very difficult to monitor, UBA has submitted an alternative proposal that is based on a plastic rate. Although this proposal was supported both by disposal firms and by manufacturers, it failed in Brussels.

UBA supports the work on the directive and the amendment of the appendix to the proposed directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment in order to reflect the state of scientific progress. This is the aim of a research project on "Environmental effects and the resulting need for action as a result of the ban on lead in the EU directives on end-of-life vehicles and electrical and electronic equipment". This project is managed by the Federal Institute for Geosciences and Natural Resources (BGR). With the co-operation of the Fraunhofer Institute for Reliability and Microintegration (IZM) and the Institut für Ökologie und Politik GmbH (Ökopol), this research projects studies and documents ways for systematically assessing the relevant effects on the environment when using replacement substances for lead.

(III 2.4)

Batteries

Since 1998, manufacturers and sellers of batteries have been obliged to take back all old batteries pursuant to the *Battery Ordinance (BattV)*. Joint collection systems were set up for this purpose. The annual reports published by the operators of these systems are examined and evaluated by UBA.

The collection rates are calculated as the ratio between the quantity collected compared to the quantity sold. Unlike other ordinances, however, the Battery Ordinance does not set forth any mandatory rates or quota. The collection rates are currently still low at around 30 %.

Core aspects of the proposed EC Directive for Waste Electrical and Electronic Equipment and for Hazardous Substances in Electrical Equipment

Individual and collective systems
In order to achieve the aims of the *EC Ordinance for End-of-life Electrical Appliances*, manufacturers can operate individual and collective systems for collection, treatment, recycling and overall financing if this is compatible with competition law.

Reducing pollutants in wastes
Treatment and recycling of all separately collected end-of-life electrical appliances and electronic devices are aimed at eliminating particularly hazardous substances and components from the waste stream in accordance with defined minimum standards.

Financing
The manufacturers assume product responsibility, i.e. the financial and organizational responsibility for the treatment, recycling and environmentally compatible disposal of old appliances from their own production and equivalent products. They are at liberty to implement this product responsibility as an individual or collective system.

Resource protection through quantity targets
Recycling of complete appliances and devices is a priority aim. A collection rate of 4 kg of old appliances from private households per capita per year is aimed at. The appliances are divided into ten categories. Re-use rates (70 to 80 %) and recycling rates (50 to 80 %) are defined for the treatment of all devices and appliances, i.e. including commercial equipment, of the different categories.

Avoidance of hazardous substances
The use of certain hazardous substances – such as the heavy metals lead, cadmium and mercury, hexavalent chromium [chromium (VI)] and bromine-containing flame retardants – in electrical appliances and electronic devices will (with some exceptions) be banned by 1 January 2007 at the latest.

The picture is similar in the other EU member states. Although the Netherlands officially records significantly higher rates, this is due to the fact that the batteries "available for collection" rather than the batteries sold are used as the reference value. This quantity corresponds to the total number of batteries which are actually separately collected and disposed of in household waste. UBA objects to a comparable approach in Germany. Data of this kind is calculated by extrapolation from random samples and is hence relatively inaccurate and, even worse, does not include batteries disposed of illegally.

The low collection rates are a particular problem because several battery types contain hazardous heavy metals. Batteries of this type are not just round cells with a mercury content of 2 %, but, above all, rechargeable nickel-cadmium (NiCd) accumulators with a cadmium content of around 20 %.

Cadmium is one of the most dangerous heavy metals for human health and the environment. Preventive environmental policy must aim at minimising cadmium emissions into the environment. This is also the aim of the *EC Battery Directive (Directive 91/157/EEC)* which is also the basis of the German ordinance.

Since other member states also failed to achieve satisfactory collection rates, the EU Commission's Environment Directorate developed drafts for a revision of the EC Battery Directive in 2001, foreseeing a limitation of the permissible cadmium content of batteries and accumulators to 0.002 percent per weight as of the year 2008, which would be equivalent to a ban on NiCd accumulators. However, such a revision never materialized.

UBA is continuing its efforts in favour of such a limitation. A ban on NiCd accumulators is no problem whatsoever because equivalent alternatives exist for practically all applications, for example, in the form of nickel-metal hydride accumulators.

The limitation of the mercury content under the EC Battery Guideline and the German Battery Ordinance to 0.0005 percent by weight (except for round cells) which has already come into effect has already led to a significant reduction of mercury immissions into household waste due to batteries and to better battery recycling conditions.

Old vehicles

The *EC Old-vehicles Directive (Directive 2000/53/EC)* was passed on 18 September 2000. The main aims of the directive are:

- To avoid environmental hazards during the disposal of old vehicles
- To reduce the volumes of waste due to the disposal of old vehicles
- To recycle the resultant waste to the maximum extent and at the highest value level possible

These aims are to be achieved by regulations concerning the manufacture, collection and treatment of vehicles (see box on the right).

In Germany, the *Old-vehicle Ordinance* has been in effect since 1998. Within the scope of the Old Vehicles Act that came into effect in July 2002, the Old Vehicles Ordinance was renamed and amended in line with the requirements of the EC Directive. The Old Vehicles Act focuses on the following elements:

The **bans on pollutants and recycling rates** of the EC Directive (see box) are adopted. This includes the treatment requirements which were in part defined in much more detail. These requirements are summarized in the appendix to the Old Vehicles Ordinance and were developed with substantial co-operation on the part of UBA.

Car manufacturers will be obliged to **take back their cars free of charge** from the last owner. This applies to new vehicles as of 1 July 2002 and for all other cars as of 1 January 2007. This means that manufacturers will initially pay the disposal costs in full. These costs can, however, be passed on to car buyers, so that lower costs for environmentally compatible disposal will have a favourable effect on the price of new vehicles.

Recycling rates are calculated separately for metals and non-metal materials.

Recycling rates for the metal content are calculated on the basis of the general assumption that at least 70 % of the vehicle weight can be recycled in the form of metals. This part of the rate does not have to be demonstrated separately. (The value is made up of a metal content of around 75 % and a metal recycling rate of 97 %). The remaining recycling and re-use rates of non-metal materials must be achieved by dismantling and shredder operations. As a rule, dismantling companies have to recycle or re-use 10 % of the vehicle weight in the form of non-metal materials, whilst shredder firms must recycle the remaining 5 or 15 percent by weight of non-metal shredder residues. Shredder and dismantling firms can, however, co-operate and jointly demonstrate that the required rates are achieved.

Central elements of the EC Old-vehicles Guideline

Waste avoidance
In order to avoid pollutant-laden waste to the maximum extent possible, the use of certain hazardous substances in the production of new vehicles is banned. The use of toxic heavy metals, i.e. lead, cadmium, mercury and chromium (VI) is no longer permitted with the exception of certain substances which are explicitly listed in an appendix.

Collection of used cars
Starting in 2007, every vehicle owner must have the possibility to deliver his or her old car to a recycling firm for free disposal. The costs for this programme are to be borne by car manufacturers, either completely or to a substantial degree.

Treatment
Minimum standards are defined for the treatment – i.e. disassembling, recycling, waste disposal – of old cars.

Re-use and recycling
As of 2006, the re-use rate of old cars must be at least 85 %, and as high as 95 % as of 2015. The "re-use" category includes energy recovery. 80 % of an old car's weight must be recycled. This figure will even be up to 85 % as of the year 2015.

Information
Manufacturers are obliged to make disassembly information available to the recycling firms. Furthermore, certain labelling obligations must be fulfilled in order to facilitate the subsequent re-use and recycling of parts and materials.

Furthermore, all the parties involved are called upon to close material circulation loops in order to improve the markets for recycled material. Car manufacturers are obliged to document their efforts to this effect.

Firms will be monitored by certification bodies. Experts monitor and audit the companies, so that public authorities – apart from random inspections – only have to check whether a certificate was issued. Owners wishing to dispose of their vehicle require proof of recycling by a certified dismantling firm or a declaration stating that the vehicle was not disposed but, for example, sold.

As a result of this new Old Vehicles Ordinance, UBA expects a decline in the number of old vehicles disposed of illegally as soon as the regulations on free collection come into effect. The more detailed definition of requirements for dismantling and shredding firms will probably lead to a more environment-friendly treatment of old vehicles. The pollutant burdens of waste streams will be reduced by the targeted elimination of pollutant-containing components and materials, as well as the ban on the use of certain heavy metals. The re-use and recycling obligations will help protect natural resources. Certified firms will hence meet with demanding standards in future. The enforcement agencies will, however, remain in charge of the difficult task of preventing illegal disposal by non-certified firms. *(III 2.4)*

Product responsibility and integrated product policy

The integrated product policy was introduced in much detail with the focal subject of "sustainable consumption" in the 2000 annual report. Developments in this political field have proceeded further [42] (refer also to chapter 10 on this subject).

Within the scope of its strategy for sustainable development, the EU presented its "Green Paper on Integrated Product Policy" in spring 2001 [43]. The integrated product policy is thus considered as a supplement to existing instruments of environmental policy that makes use of formerly unused potential in order to improve the products during their lifetime. Apart from the role of the groups involved, the green paper specifically addresses the issues of price mechanisms, instruments for promoting environmentally conscious consumption, as well as incentives for strengthening the supply of environment-friendly products.

The green paper was discussed in 2001 at various stakeholder conferences with European interest groups and the member states. The EU Commission has announced the presentation of a white paper on integrated product policy at the beginning of 2002. This paper will address not just programmatic approaches, but also concrete measures. In 2001, UBA was involved in numerous issues of integrated product policy and in the expansion of product responsibility, for example, with regard to environment-friendly sourcing, standardization and eco-labelling (refer to chapter 2). *(III 1.3)*

"Blue Eco-Angel" and the "EU Flower" – reliable emblems for consumers

In order to offer quick and reliable information on the environmental relevance of a product through voluntary marks, the EU Commission, the Federal Ministry for the environment, UBA and the eco-label jury launched several initiatives. A work plan was adopted both for the German "Blue Eco-angel" label and for the European "EU Flower" eco-label in order to make procedures more transparent and to identify focal issues by the year 2003. Use and communication of the "Blue Eco-Angel" and the "EU Flower" are being promoted in a new marketing approach. Short processing times for the new eco-label within the "Blue Eco-Angel" label now reflect the often short product innovation cycles (for details, see part 2, pages 150 and following).

Although environmental protection is still an important issue for Germans, other issues are in the focus of everyday politics. Notwithstanding this, the "Blue Eco-angel" continues to be very popular far beyond national borders. UBA, for example, is receiving an ever-growing number of queries from Asia concerning the use of the "Blue Eco-Angel" and the definition of criteria.

Together with the eco-label jury and the Federal Ministry for the Environment, UBA has commissioned the development of a marketing strategy for the "Blue Eco-Angel" which formed the framework for an event held in November 2001 titled "The Blue Eco-Angel on New Ways towards the Public" in the presence of representatives from consumer organizations, multipli-

ers, business and the media. The Blue Eco-Angel's asset – its high credibility – is to be increasingly communicated to the general public in order to emphasise the quality of this label in an environment of growing competition by other brands and labels. The focal issues of this campaign are as follows:

Marketing is to be increasingly based on co-operation between retailers on the one hand and environmental and consumer organizations on the other. In this context, mass-media advertising will play an important role, depending on the different target and product groups. In order to increasingly distinguish eco-labelling as a co-operative instrument of sustainable product policy, the new homepage www.blauer-engel.de increasingly addresses younger target groups and retailers (page 150).

In line with climate protection and sustainable development as central environmental issues, the work plan of the eco-label jury that was adopted in November 2001 emphasises the product groups of "information and communications technology" and "construction products".

Environment-orientated and health-related criteria are equally important for the eco-labels for construction products and furniture. Emissions from products can affect the users' health via the indoor air. The 2000 annual report includes an overview of the low-emission products which currently bear the eco-label. Further eco-labels for low-emission products in the living environment (flooring and flooring adhesives) are in preparation or planned (refer to chapter 6 for details). *(III 1.3)*

[40] Sources for the complete texts on the Internet:

Old-vehicle Ordinance: http://www.bmu.de/sachthemen/abfallwirtschaft/bmu_stadt/verkehr/detail/altautovo.php

Cabinet draft bill for an end-of-life vehicle act: http://www.bmu.de/download/b_autoalt.php

EC End-of-Life Vehicles Directive (Directive 2000/53/EC): http://europa.eu.int/eur-lex/de/lif/dat/2000/de_300L0053.html)

[41] Sources for the joint standpoint http://ue.eu.int, Public Register of Council Documents: documents 11304/01 and 11356/01

[42] The latest version is to be found on the Internet at www.europa.eu.int/comm/environment/ipp/home.htm

[43] Address: europa.eu.int/eur-lex/de/com/gpr/2001/com2001_0068de01.pdf

10. All-inclusive: integrated environmental protection in industrial plants

Overview

- Introduction
- Plant-related environmental protection in the European Union
- Reporting obligations and publication of emission data
- Integrated environmental protection in international treaties and conventions
- Integrated environmental protection in Germany
- Promotion projects and technology transfer

Introduction

Substantial progress was made in recent years in reducing pollutant emissions and the consumption of resources by industrial plants. However, the aim of **SUSTAINABLE PRODUCTION** is still a long way down the road. Environmental aspects must be increasingly considered during product development on the one hand, and production must focus more on sustainability on the other.

INTEGRATED ENVIRONMENTAL PROTECTION includes all media, i.e. air, water, soil, energy and raw material consumption, as well as waste avoidance and recycling. Apart from downstream environmental protection techniques which will continue to be an important task, the integration of environmental protection aspects into the selection and design of production processes becomes increasingly important in order to avoid environmental pollution from the very beginning, if possible.

Plant-related environmental protection in the European Union

The European Union (EU) is pursuing two parallel strategies for plant-related environmental protection.

- In line with the principle of prevention, a limitation of emissions from plant is demanded on the basis of the best available techniques.
- Quality standards or targets for pollutant concentration levels in the environment are defined in order to protect citizens and the environment.

Thee *EU Directive on Integrated Pollution Prevention and Control (Directive 96/61/EC, IPPC Directive)* of 30 October 1996 uses a pan-media concept in order to set forth measures and approval procedures for industrial plants with a particular rele-

Integrated environmental protection: *In Germany, integrated environmental protection is often considered as production-integrated environmental protection, i.e. measures for avoiding emissions and for saving energy and raw materials right during the production process. In the EU, this term generally includes both production-integrated environmental protection and environmental protection at the downstream end of the production process on the basis of a concept that covers all media (air, water, soil, also taking further environmental aspects into consideration). In a broader sense, the term also includes product-integrated environmental protection which addresses environmental issues related to the development, use and disposal of products. This is also the meaning of this term in this chapter.*

Sustainable production: *The aim of sustainable production is a result of the Agenda 21 requirements. Chapter 30 of the Agenda 21 calls upon business and industry to pursue a responsible approach towards natural resources, as well as business policies aimed at sustainable development. Sustainable production includes production-integrated and downstream environmental protection, as well as product-integrated environmental protection, considering all the environmental media in each case.*

vance for the environment. This directive was implemented in German law with the coming into effect on 3 August 2001 of the Article Act (see below, integrated environmental protection in Germany). The aim is to achieve a high protection level for the environment as a whole. Application of BATs (Best Available Techniques) is a central element of the directive. BAT Reference Documents (BREFs) are developed for all the sectors of industry concerned during the course of an information exchange between member states, industry representatives and environmental groups [44]. 12 of these documents have been adopted by now. Table 4 (page 74) gives an overview of all BREFs.

In its capacity as Germany's national co-ordination centre for this information exchange, the UBA has actively co-operated with Federal-state agencies and industry associations in shaping the BREF work, contributing process, emission and consumption data for state-of-the-art processes and technologies.

The BREFs will supply a wealth of data on best available techniques for important industries within a relatively short time. The BREFs do not set forth any emission limits and thus have no binding legal effect. They must, however, be taken into consideration when it comes to defining limit values on the basis of what is the latest state of the art. The different national reports on the implementation of the directive will show how effective the BREFs actually are. One can expect that the BREFs, thanks to their universal use and reliable data will constitute a very important and high-level instrument with a view to harmonizing environmental protection requirements in Europe.

The IPPC Directive calls for the use of BATs in order to keep emissions into and their effects on the entire environment at the lowest level possible. With regard to the identification of environment-compatible production techniques and processes, it may be necessary to find the right balance between different effects on the environment, such as pollutant emissions into the air and waste water discharge onto waters. The work group for the so-called cross-section BREF "Economic and pan-media aspects" deals with complex task, as well as the calculation of costs in conjunction with the application of BATs. On behalf of the Federal Environmental Agency (UBA), a method was developed for this work which enables a comparison of the environmental effects of different techniques on the basis of a simplified eco-balance approach [45] (refer to part 2, page 155). Besides concepts from other EU member states, this method is to become part of a guideline for BREF work. It is designed to offer systematic support for the selection of BATs in the BREFs. Practical testing of the applicability of this guideline for more complex – such as production-integrated – techniques is still pending. *(III 2.1)*

Reporting obligations and publication of emission data

Different reporting obligations of the member states support the implementation of the IPPC Directive and create the basis for assessing the efficiency of environmental protection measures. First of all, the European Pollutant Emission Register (EPER) publishes information on emissions and their sources (annual burdens) every three years. Secondly, the EU Commission must be informed about the emission requirements for plants in the different member states. This means that the requirement levels in the member states can be compared.

The EU Commission can this information as a basis for preparing proposals for the definition of community-wide emission limits for submission to the EU Council of Ministers. This will increase pressure towards pan-European harmonization.

The UBA prepares the reports in co-operation with the Federal-state governments. The first German report on emission requirements was submitted 2001. The first report of this kind for the EPER is due in June 2003. The reports will be published on the Internet. *(III 2.1, II 3.2, II 6.3)*

Integrated environmental protection in international treaties and conventions

Further obligations to apply BATs to industrial plants result from various international environmental protection conventions, such as the *Geneva Convention on Long Range Transboundary Air Pollution* prepared by the United Nations Economic Commission for Europe (UN-ECE) and the Marine Protection Convention, i.e. the *OSPAR Convention* for the North Sea and the North East Atlantic, as well as the *Helsinki Convention* for the Baltic Sea.

Table 4: Overview of the status of the BAT work

Completed BREFs

- *Iron and steelmaking industry*
- *Cement and lime industry*
- *Paper and pulp production*
- *Nonferrous metal industry*
- *Industrial re-cooling systems*
- *Chlorine-alkali industry*
- *Metal processing*
- *Glass industry*
- *Tanneries*
- *Refineries*
- *Chemical plants for the production of organic basic chemicals*
- *Cross-sectional BREF: Exhaust gas and waste-water management/treatment in the chemical industry*

Work in progress yet without draft BREF

- *Foundries and forges*
- *Abattoirs/animal processing/plants*
- *Cross-sectional BREF: Pan-media and economic aspects*
- *Food industry*
- *Chemical plants for the production of inorganic basic chemicals Ammonium, acids and fertilizers (new classification in the field of inorganic chemistry)*
- *Chemical plants for the production of inorganic basic chemicals Solid and other chemicals (new classification in the field of inorganic chemistry)*

Draft BREF available:

- *Cross-sectional BREF: Monitoring*
- *Intensive animal farming*
- *Textile industry*
- *Large-scale combustion plants*
- *Cross-sectional BREF: Emissions from the storage of hazardous substances and dust-generating goods*

Other BREFs in the work programme

- *Surface treatment of metals (electroplating)*
- *Ceramic industry*
- *Polymer production*
- *Surface treatment using solvents*
- *Waste incineration plants*
- *Plants for the treatment/ recycling of waste*
- *Inorganic special chemicals*
- *Organic fine chemicals*

Protection of the North Sea and North East Atlantic: Within the framework of OSPAR, measures are laid down – including measures for point sources – in order to protect the North Sea and the North East Atlantic. The contracting parties undertake to minimise immissions of hazardous substances from industrial plants and to ensure the application of BATs with the aim of a complete avoidance or of achieving natural background concentrations. 42 priority hazardous substances for which emissions must be avoided by the year 2020 have so far been selected according to their persistence, bioaccumulation potential and toxicity.

In order to achieve these aims, the work group on point and diffuse sources can propose binding meas-

ures for products and production processes within the scope of the strategy for hazardous substances. Most contracting states have, however, become increasingly reluctant to develop and adopt demanding environmental standards, reasoning that even more demanding measures are to be expected as a result of the latest activities pursuant to the EU's IPPC Directive and the *EC Water Directive (Directive 2000/60/EC Establishing a Framework for Community Action in the Field of Water Policy)*. Although the UBA also advocates the effective use of technical capacities – in particular, in order to avoid parallel work – it still sees substantial work ahead for the work group on point and diffuse sources because some of the marine protection aims are significantly more restrictive than existing EU regulations.

Protection of the Baltic Sea: The procedures and measures of the Helsinki Commission (HELCOM) are similar to the OSPAR measures. Besides activities which directly concern the marine environment and navigation, emission reduction measures are defined for industrial and communal point sources. Immissions of hazardous substances into the Baltic Sea are also to be avoided almost completely by the year 2020. In the HELCOM context, the LAND work group (Land-based Pollution Group) benefited from the EU's activities, in particular, the BREF work. However, since with Russia, Belorussia, the Baltic States and Poland the majority of the member states are not (yet) EU member states, the harmonisation of environmental protection measures should be supported at a high level within the HELCOM framework.

In reality, there is a clear orientation and gradual adaptation of measures to the relevant EU standards and requirements. Important activities include the nation-wide biological treatment of communal waste water and the increased adoption of BATs in preventive, plant-related environmental protection. The next reports on the implementation of the HELCOM recommendations will be submitted parallel to the reports on the implementation of the EU's IPPC directive on industrial plants, and will enable a comparison of industrial environmental protection standards.

Integrated environmental protection in Germany

The requirements of the EC IPPC Directive were implemented in German law with the coming into effect on 3 August 2001 of the article act. This act adapted, in particular, the provisions of the *Federal Immission Protection Act (BImSchG),* of the *Federal Water Act (WHG)* and of the *Recycling and Waste Act (KrW/AbfG)* to the EU requirements.

As an additional measure, important parts of the existing technical and administrative tools are currently revised. This includes, for example, emission limits for air and water, taking pan-media aspects into consideration. This measure is based on state of the art (corresponding largely to the BAT) and thus ensures a high level of protection for the environment as a whole. Information from the BREFs is directly integrated into this work.

Air pollution control: The *Technical Instructions on Air Quality Control (TA Luft)* is the first general set of administrative regulations concerning the Federal Immission Protection Act. The Technical Instructions on Air Quality Control set forth the immission protection standards for plants which have to be considered by public authorities and agencies in their approval and licensing procedures. The technical instructions on air quality control contain immission values as a protection against harmful effects of air pollution on the environment in order to ward off hazards, as well as emission values in order to limit pollutant emissions at the place of origin as a preventive measure against harmful effects on the environment. Both requirements must be adhered to when plants and installations are built and operated.

The technical instructions on air quality control in their 1986 version had to be adapted to the advanced state of the art and to new European legislation. Apart from the *EC Directive on Air Quality (Council Directive 96/62/EC on Ambient Air Quality Assessment and Management)* and its daughter directives, it was, above all, the requirements of the EC IPPC Directive which had to be taken into consideration, in particular, in order to determine emission values on the basis of an integrated, pan-media approach and, if possible, to upgrade existing plants to state-of-the-art levels by October 2007. The BREFs so far developed were considered in this context. Furthermore, the state of the art reflected by the new technical instructions on air quality control will, on its part, be integrated into the development of new or the updating of existing BREFs in order to contribute towards a European harmonization of the state of the art at a high environmental protection level.

The huge success of the 1986 version of the technical instructions on air quality control was due to the fact that emission values based on state-of-the-art technology for almost all industrial and commercial facilities and plants requiring approval are set forth in a single set of instructions with a uniform, understandable concept. This is why the revised technical instructions on air quality control will retain the current concept with the following core elements:

- The prevention requirements are aimed at a harmonized and uniform enforcement of the technical instructions on air quality (principle of equitable treatment). This also includes a requirement that plants must be monitored on the basis of uniform measuring and assessment methods.
- Emissions of hazardous substances are restricted more than emissions of less hazardous substances.
- Emissions of particularly hazardous substances, such as dioxins and furans, as well as carcinogenic, mutagenic or reproduction-toxic substances are subject to the most restrictive requirements and must be limited to the maximum extent possible (emission minimising requirement).
- Emissions from small plants are subject to the definition of "petty mass flows" which are less restrictive than the requirements for large plants.
- Besides generally applicable requirements for all plant types, special requirements for specific plant types will be added in order to address – as far as possible – the different technical properties of different plant types and thus to apply the principle of commensurability.
- One central element of the new technical instructions on air quality control concerns requirements for existing plants. Subject to reasonable transitional periods, existing plants must be generally upgraded to approach the state-of-the-art of new plants. The standard term for rehabilitating existing plants is five, the maximum term being ten years. The new technical instructions on air quality control concern 50,000 to 55,000 industrial and commercial plants.

The new technical instructions on air quality control constitute an up-to-date tool for public agencies and authorities for air quality management. Nation-wide standards for approval procedures ensure more legal and planning certainty when it comes to the approval of plants. This is equally helpful for public authorities and companies alike.

The standards for new and existing plants not just mean improvements for environmental protection, but also help identify and use optimization potentials at plant level. Environmental protection requirements are usually linked to fundamental plant revamping programmes which can yield significant economic advantages.

The implementation of the technical instructions on air quality control will lead to a significant reduction of pollutant emissions from many plants requiring approval (notably with regard to fine dust, heavy metals, as well as carcinogenic. mutagenic or reproduction-toxic substances, as well as bulk pollutants, such as nitrogen oxides, sulphur oxides and organic substances in general), thereby improving the environmental quality in the vicinity of many plants to a considerable degree.

The UBA has supported the Federal Ministry for the Environment in these efforts. The following issues deserve special mention in this context:

- Implementation of the requirements of the IPPC guideline with regard to multiple media and protection aims at a concept level
- Preparation of proposals for emission-limiting prevention requirements with reasons, for example, for emission values in accordance with the state of the art
- Modernization of the requirements for plant monitoring
- Development of a program for calculating the transport of pollutants in the vicinity of a plant on the basis of scientific methods.

Following a hearing of the circles involved, the Federal cabinet approved the new draft technical instructions for air quality control on 12 December 2001 and submitted these to the Bundesrat for its approval [46]. The technical instructions on air quality control are planned to come into effect in 2002.
(III 2.1)

Waste water immissions: In Germany, the relevant state-of-the-art requirements for immissions of waste water into waters are laid down in the Ordinance on Requirements for Immissions of Waste Water into Waters *(Waste-water Ordinance, AbwV)* pursuant to section 7a of the Federal Water Act (WHG) and around 60 industry-specific appendixes. These requirements were developed by expert groups on behalf of the Federal Ministry for the Environment with

UBA experts for the individual sectors of industry being members of these groups.

The UBA is hence actively involved in the revision of the appendixes to the waste-water ordinance. In this context, the expert groups also have to examine whether the description of the best available techniques in the BREFs suggests a special demand for updating these appendixes.

In this context, the integrating, pan-media approach which is already laid down in section 3, subsection 2 of the waste-water ordinance is increasingly used. With a view to the effective nation-wide protection of waters, general, nation-wide requirements for waste-water immissions irrespective of the given condition of individual waters are still indispensable. *(III 3.5)*

Promotion projects and technology transfer

Recent measures within the scope of the investment programme of the Federal Ministry for the Environment for reducing environmental pollution (refer to part 2, page 146) increasingly promote projects on integrated environmental protection. This includes a project on reducing dust an dioxin emissions of an electric steelworks, a project on the commissioning of the first SCR plant in a cement works and a project for the low-waste manufacture of a raw-material substance for antibiotic drugs. (For project results, refer to part 2, pages 156 and following). The results are a German contribution towards the exchange of information on BAT. Furthermore, these results are also an important source of information in order to update the state of the art in national regulations.

Besides promoting and supporting integrated environmental technologies and actively communicating these technologies at a European level, the UBA is determined to promote the transfer of environmental technology world-wide. The Internet portal on environmental technology transfer at www.cleaner-production.de offers comprehensive information on the efficiency and capabilities of German environmental technologies. Besides the UBA, many other German institutions use this platform in order to present information on technical environmental protection. In accordance with the Agenda 21 (refer to chapter 1), this portal is to improve the world-wide access to environmentally compatible techniques and to generate interest in German environmental technologies on offer. *(III 1.1)*

[44] BREFs and draft BREFs are available on the Internet at eippcb.jrc.es. For up-to-date information concerning BREFs, you may also wish to visit the UBA's homepage at www.umweltbundesamt.de/nfp-bat.

[45] The study "Medienübergreifende Bewertung von Umweltbelastungen durch bestimmte industrielle Tätigkeiten" (Pan-media assessment of environmental burdens caused by certain industrial activities) is available on loan from the UBA's library under number UBA-FB 298 94 312 (address on page 2).

[46] The draft is available on the Internet at www.bmu.de.

11. Plant safety and accident prevention

Overview

- Introduction
- Accident-relevant locations in the Danube basin
- Transport of hazardous substances in the Black Sea and in the Caspian Sea
- Concept for documenting the state of safety technology
- Tools for accident prevention
- Industry parks and accident law

Introduction

Issues of plant safety and accident prevention have largely vanished from the public debate because a host of effective laws and regulations were adopted or revised at German and European level after the alarming accidents in the 1970s and 1980s (such as Seveso in 1976 and the Sandoz accident in 1986). However, the events in Enschede (explosion of a warehouse for fireworks, 2000), Baia Mare (immission of cyanide-containing waste water into the river Tisza, 2000) and Toulouse (ammonium nitrate explosion, 2001) with partly devastating consequences for man and the environment show that hazards still exist everywhere in Europe despite the knowledge of hazardous substances.

Another hazard is illegal action, something that seemed unthinkable before September 11, 2001. After the terrorist attacks in the United States of America, hazards for man and the environment by illegal intervention in hazardous industrial plants must be re-assessed. In order to improve the prevention situation, the possible effects of illegal action on typical plants must be systematically identified in terms of the related risks, and suitable technical and organizational preventive measures must be taken in order to minimize these hazards. First proposals to this effect were developed and published in January 2002 by the Accident Commission with the Federal Environmental Agency's (UBA) co-operation. [47] This issue is also addressed in a project by the Environmental Research Plan (UFOPLAN).

Accident: *An event – such as an emission, a fire or a major explosion – that results from malfunction during operation in a plant area or plant and that results in serious danger or substantial damage to property.*

Accident-relevant locations in the Danube basin

As a result of the cyanide accident in the Romanian Tisza basin in 2000 (refer to the 2000 annual report), the countries bordering the Danube felt obliged to analyse the **ACCIDENT**-relevant locations in the Danube basin. The result of this effort is the "Inventory of Potential Risk Spots in the Danube River Basin" which was presented on 27/28 November 2001 by the "International Commission for the Protection of the Danube" (IKSD). UBA was the agency responsible for the preparation of the inventory.

One aspect that deserves special mention from the German point of view is the fact that evaluations were based on tried-and-tested procedures which had already been successfully adopted for the rivers Elbe and Rhine.

The background: The Danube basin made headlines, in particular, as a result of the cyanide accident in the Romanian city of Baia Mare in 2000. As a result, the International Commission for the Protection of the Danube (IKSD) took on the issue of accident prevention and in 2001 ordered a stock-taking programme of accident-relevant plants in the entire Danube basin. The overview of potentially accident-relevant plants is one of the measures which support the international warning and alarm plan for the Danube.

Since the classification systems for accident-relevant industrial activities differ strongly between the individual countries of the Danube basin (with some countries having no such systems at all), the first step was to agree to common classification procedures.

The preparatory work by the International Commission for the Protection of the Elbe (IKSE) proved to be very useful as a basis for a comparable effort. Accordingly, plants are selected on the basis of their hazard potential which is a function of the type and quantities of water-polluting substances which are handled in these plants.

A total of 611 ARS ("accidental risk spots") were surveyed. The total amount of substances with a high hazard potential for water is in the order of around 6 million tonnes in the Danube basin, expressed in substance equivalents of water hazard class 3 (Table 5). More than one third of these substances is used in the German Danube basin, around one quarter in Romania.

Interestingly, industrial activities account for the complete water hazard potential in Germany, whilst in Romania, industrial activities account for less than 1 % of the total risk potential, with mining activities (sedimentation basins) contributing more than 99 %.

Due to the logarithmic scaling of the Water Risk Index (WRI), the difference between Hungary (WRI of 8.8) and Bulgaria (WRI of 8.6) corresponds to almost twice the amount of the risk potential. In total, the resultant distribution is absolutely plausible against the background of the economic power and industrial development of the different countries.

The Czech example illustrates which further specific results are supplied by detailed analysis. Nine accidental risk spots are identified in the Czech Republic. Two facts deserve special mention in this context.

- The risk potential of a sedimentation basin from former uranium ore processing operations exceeds – even with cautious estimates – the entire risk potential of the Czech industry by a factor of 10.
- A single ARS, i.e. a crude oil processing plant, accounts for almost the entire (99 %) "industrial" risk potential.

This example shows in what way the analysis can be used in order to ensure a targeted use of the limited resources in central and eastern European countries. [48]

However, any evaluation of these results must consider the fact that these figures alone do not permit

Table 5: Number of accidental risk spots and total risk potential

Country	*Reported ARSs*	*Evaluated ARSs*	*Total quantity (WHC 3 – equivalents) [Kg]*	*Overall Water Risk Index (WRI) $\log_{10}$ (total quantity)*
Bulgaria	*29*	*28*	*370,000,000*	*8.6*
Germany	*56*	*56*	*2,293,874,000*	*9.4*
Croatia	*30*	*26*	*135,734,760*	*8.1*
Moldavia	*27*	*14*	*3,634,610*	*6.6*
Romania	*67*	*59*	*2,076,893,274*	*9.3*
Slovakia	*148*	*145*	*250,877,521*	*8.4*
Slovenia	*2*	*2*	*980,000*	*6.0*
Czech Rep.	*9*	*8*	*144,617,790*	*8.2*
Hungary	*243*	*242*	*706,603,002*	*8.8*
Total	*611*	*580*	*5,982,720,034*	*9.8*

WHC = Water hazard class

any absolute statement on the real hazard. In order to determine the real hazard, the safety precautions and accident prevention measures in force at the various sites must be taken into consideration. The philosophy of protecting waters against pollution caused by industrial plants in highly industrialised nations is based on the concept of compensating potential hazards to waters by far-reaching safety precautions at a technical and organizational level. Safety and accident prevention measures at the registered sites must be examined by local authorities on location.

This inventory is hence primarily a tool that enables the identification of plants where, in view of their hazard potential, safety and accident prevention measures should be checked as a matter of priority.

Within the scope of a joint consultancy project by the Federal Ministry for the Environment and UBA on "Technology transfer for the protection of waters against pollution caused by industrial plants", check-lists for determining the safety measures of plants that are potentially hazardous to waters were developed and tested at a number of sites in Romania and the Republic of Moldavia. This project was, for its part, based on the safety measures recommended by the International Commissions for the Protection of the Rhine and the Elbe.

In response to the inventory described, this commission recommended that its contracting parties use these check-lists to check plants identified as potentially hazardous to water.

Transport of hazardous substances in the region of the Black Sea and Caspian Sea

As a result of a workshop in Georgia in autumn 1999 that was also attended by UBA representatives on "Pipeline safety in the Caucasus", the Committee on the Challenges of Modern Society of the North Atlantic Treaty Organization (NATO/CCMS) launched a project that targets close technical co-operation between the countries in the Black Sea and Caspian Sea regions and several NATO partners. The aim was to propose steps in order to enforce environmental protection requirements for the transport of hazardous substances from the oil and gas industry in the Black Sea and Caspian Sea regions. The project was managed by Turkey and Georgia. Other participant countries included Azerbaidshan, Macedonia, Kazakhstan, Ukraine, Canada, Germany (represented by UBA and the Federal Institute for Materials Research and Testing (BAM)) as well as the US, Moldavia, Bulgaria, Armenia and Russia for some of the time. The project was concluded in December 2001.

Apart from long-term environmental monitoring programmes along the transport routes, the report also recommends risk assessments for transport projects, including the identification of adequate safety measures in order to prevent accidents and reduce the effects of damage. A foundation basis will be created for this effort.

Another point of focus are recommendations for involving the general public in projects related to the oil and gas sector. The report also proposes activities with the aim of implementing harmonised environmental protection legislation in the countries concerned in the long term.

This project can be regarded as another step towards improved co-operation between the countries in the Black Sea and Caspian Sea regions. Its aim is to foster and effectively implement environmental protection in conjunction with the transport of hazardous materials. [49]

Concept for documenting the state of safety technology

The German *Accident Reporting Ordinance (StörfallV)* provides that adherence to state-of-the-art safety and protection technology is mandatory for certain plant areas and plants. This vague legal term "state-of-the-art safety and protection technology" covers the state of development of advanced methods, equipment and operations. It is, however, an often time-consuming and costly and sometimes generally difficult exercise to identify what is "state-of-the-art safety and protection technology". One of the reasons, for example, is that information concerning state-of-the-art safety and protection technology is distributed to a host of technical rules, guidelines, standards, directives, etc. Furthermore, practical experience must be taken into consideration when it comes to determining what state-of-the-art safety and protection technology is. In order to improve the basis for determining what state-of-the-art safety and protection technology is, UBA commissioned a research project on the development of a documentation system to this effect.

An integrated research project by six research organizations compiled a database with selected safety concepts as part of a documentation system for state-of-the-art safety and protection technology. The project is designed to support the safety assessment of storage and production facilities and covers the following sub-projects:

- General-cargo warehouses
- Ammonia-based refrigerating equipment
- Gas storage facilities
- Storage facilities for fluids
- Production plants
- IT support and software development

One of the most important new features of this information system is that the analysis focuses on process studies and a safety-technology based solution approach. In contrast to databases and comments focusing on technical rules or specific legal provisions, this new concept enables a much clearer identification of progress in the field of processes and safety technology.

The documentation system will support communication between experts on the basis of a joint information and language platform. For this purpose, a successor project will provide a database query tool and a discussion forum on the Internet starting in 2002. [50]

Tools for accident prevention

The Accident Reporting Ordinance was revised in May 2000. One of the essential new elements is the requirement for developing an accident prevention concept. This concept must consider the following requirements of the Accident Reporting Ordinance:

- Accident prevention must be laid down as a priority corporate aim.
- Operators are obliged to implement safety concepts which must set forth procedures for determining potential sources of hazard as well as measures for preventing hazards from materializing and for limiting their effects during the entire life cycle of plants.
- As a precondition for preventing accidents and limiting their effects, existing laws and regulations, as well as technical rules and standards must be adhered to. Furthermore, state-of-the-art safety and protection technology must be adopted.
- The concept must contain definitions for checking and analysing its own efficiency, and must be further developed and updated as required.
- The concept is based on a safety management system, and will be implemented within the scope of such a system.

Within the scope of the Environmental Research Plan (UFOPLAN), UBA has commissioned RWTÜV-Anlagentechnik, Essen, with a research project on the "Development of tools for the implementation of the concept for preventing serious accidents pursuant to the revised Accident Reporting Ordinance". The tools presented in the final report suggest aspects to be taken into consideration during the development of an accident prevention concepts, including the degree of detail appropriate for such a project. [51]

Industry parks and accident law

Industry parks that have developed at numerous industrial sites in recent years and which are often the result of a splitting up of former factory sites are characterized by a dense neighbourhood of several companies and their interaction in terms of substances, materials and energy use. Links between the individual companies in industry parks and their infrastructure operators often exist at company law level. Problems related to the (new) definition and assignment of environmental obligations arise not alone, but to a large extent, at accident law level which is undergoing a process of change anyway as a result of the implementation of the *EC Seveso II Directive (Directive 96/82/EC)*. This induced UBA in 1999 to commission the Cologne-based Gerling Risiko Consulting GmbH with a research project on the issue of accident-prone companies in industry parks.

Four industry parks were analysed in order to find a definition for the terms "operator" and "works area" and to determine which influence links between the companies operating at a site have at company law level with regard to their obligations under accident law. Finally, the models identified were used as a basis for analysing which specific requirements exist for industry parks with chemical companies with regard to their safety responsibility and which possibilities exist on the part of public agencies to issue orders. [52]

The study concluded that, despite existing links and historically grown relationships between the individual

companies of an industry park, every operator is usually responsible for the hazard potential that can be assigned to him alone. The legal splitting up of formerly consolidated hazard potentials can hence mean that certain companies no longer reach the minimum levels set forth in the Accident Reporting Ordinance, so that this ordinance is thus no longer applicable to them. The authors of the study note that an obligation to consider the overall risk also exists in the case of an industry park. Accident law provides tools – chiefly in the form of the provisions on the domino effect – which enable consideration of the increased hazard potentials caused by neighbouring companies. It is, however, very difficult for public agencies to set up rules and standards as to how this aspect must be taken into consideration.

The study presents suitable models to this effect. One particularly suitable approach would be to assign to the infrastructure company central co-ordination and support duties in the case of an accident, including an obligation to operate a works fire service – on condition that this is permitted by the laws of the respective Federal state.

Some of the results of the study can be directly applied by public agencies and companies, whilst other results will become part of the administrative rules for handling accidents or will form the basis for more far-reaching activities, in particular, within the scope of the work of the commission on industrial accidents. The authors' recommendations require a measure of self-initiative by companies operating in industry parks. Whether and how existing regulations and their application will prove to be helpful must remain the subject matter of ongoing critical analysis. *(III 1.2)*

[47] The intermediate report on consequences of the terrorist attacks in the US with regard to the protection of companies and plants pursuant to the Accident Reporting Ordinance is available on the Internet at www.bmu.de/fset1024.php.

[48] The survey is available from the Secretariat of IKSD, Postfach 500, 1400 Vienna, Austria, e-mail icpdr@unvienna.org,.

[49] NATO/CCMS plans to publish the final report in 2002 on the Internet at www.nato.int/ccms.

[50] The final report and the database developed within the scope of the research project can be downloaded from the Internet at www.umweltbundesamt.de.

[51] The final report titled "Entwicklung von Arbeitshilfen zur Erstellung und Prüfung des Konzeptes zur Verhinderung von Störfällen" (Development of tools for preparing and verifying the concept for accident prevention) is available on loan from UBA's library (address on page 2) under the number FKZ 299 48 324. Furthermore, it can be downloaded from UBA's website at www.umweltbundesamt.de.

[52] Information concerning the project "Development of criteria for the responsibility for safety in the case of accidents in industry parks" is available on the Internet at www.umweltbundesamt.de/anlagen/industrieparks.html.

12. New impetus to the safety of chemicals

Overview

* Introduction
* Future management of chemical substances in the European Union
* The flame retardants example
* Long-distance propagation of substances
* Authorization procedures for biocides
* Outlook

Introduction

Preventive substance policy as part of a future-orientated environment and health policy aims to protect man and the environment against the possible harmful effects of chemical substances.

Former procedures for handling chemical substances displayed various serious shortcomings in conjunction with the registration of **NEW SUBSTANCES** pursuant to the *Chemicals Law (ChemG)* and **EXISTING SUBSTANCES** pursuant to the *EC Ordinance for Existing Substances*:

- Substantial data deficits, evaluation backlogs and regulation deficits for thousands of existing substances
- A data gathering and evaluation system that is almost exclusively orientated towards quantity thresholds and which the industry considers to be too inflexible, too bureaucratic and hostile to innovation
- Lack of incentives to replace problematic existing substances by less problematic new substances

These shortcomings should be eliminated in a new system, if possible: In a white paper published in February 2001, the EU Commission hence made proposals for a future European chemicals policy [53].

For many existing substances which are marketed in large quantities, data that would enable an assessment of their environmental hazard is not available. Furthermore, risk evaluation and risk management are a very complex and time-consuming task. Against this background, UBA has intervened in the discussion on the future chemicals policy at an early stage. The Agency's concrete proposals include:

- Industry must provide detailed information, including, in particular, on exposure issues for all relevant existing substances
- Increased consideration of environment exposure by the use of chemicals in the open environment
- Increased consideration of bioaccumulation and persistence, when necessary, with the help of an approval and licensing process
- Increased flexibility when it comes to risk assessment, focus on relevant aspects

Existing substances: *Existing substances within the scope of the EC Ordinance for Existing Substances (793/93/EEC) are chemical substances which have been commercially used and marketed in Europe before 18 September 1981. These substances are listed in the **E**uropean **In**ventory of **E**xisting **C**hemical **S**ubstances (EINECS). Of the around 100,000 substances contained in this inventory, the EU selects those substances which should be subjected to priority risk assessment because of their particularly hazardous properties, large production quantities and complex patterns of use. Environment, human health and industrial safety are included in this approach. When a risk assessment suggests that there is a need for intervention, the responsible member state develops a strategy for EU-wide risk reduction.*

New substances: *New substances are substances which are not listed in the EINECS inventory. These substances are subject to a registration obligation which covers information concerning the identity of the chemical substance, its production and disposal, as well as analytical requirements for their physical/chemical, ecotoxicological and toxicological properties for the purpose of risk assessment.*

- Similar to the approach in toxicological issues, assessments should increasingly be based on chemical rather than acute tests
- Reversal of the burden of proof in order to implement the necessary risk reduction measures more quickly

These requirements were made part of the discussion on the future chemicals policy which has became more acute in the EU since around 1998. [54].

Future management of chemical substances in the EU

In its conclusions of June 2001, the Council of the Ministers for the Environment of the European Union [55] generally welcomed the strategy proposed in the white paper and called upon the commission to develop this strategy further. The rules and procedures so far laid down in the Chemicals Law and the EU Directive on Existing Substances for the assessment and control of new and existing substances thus have to be fundamentally revised in order to:

- Protect man and the environment better against potential risks caused by chemical substances
- Promote the replacement of hazardous chemicals with less hazardous substances
- Harmonize the requirements for new and existing substances
- Increase the flexibility of substance analyses
- Give industry more responsibility
- Enable more transparency and more comprehensive access for the general public to information on industry chemicals

Risk assessment and risk management should become faster and more efficient, in particular, with regard to existing substances. The necessary tests should, whenever possible, be performed without animal experiments.

The new approach is summarised by the REACh system. This acronym means: **R**egistration, **E**valuation, **A**uthorisation of **Ch**emicals (refer to Table 6).

Registration: By the year 2012, the industry must disclose the necessary data and information as well as preliminary evaluations for all the 30,000 or so substances with an annual production or import volume exceeding one tonne. The institution to which this information must be submitted is still the subject matter of discussion.

Evaluation: Data and information concerning substances with a volume of 100 tonnes and more, as well as on so-called "substances of concern" are evaluated by the public agencies which also determine the further demand for analysis and testing. On this basis, made-to-measure test strategies can be adopted in order to bridge evaluation-relevant data gaps – faster and more effectively than before – and to evaluate all the applications of a substance with regard to their different risks.

Authorization: In its white paper, the EU Commission proposes an authorization requirement for those substances only which develop a particularly hazardous potential, such as carcinogenic, mutagenic or reproduction-toxic properties (the so-called CMR substances). The Council of Ministers for the Environment now proposes that this requirement be extended to include PBT and vPvB substances. PBTs are **p**ersistent **b**io-accumulative and **t**oxic substances, whilst vPvBs are **v**ery **p**ersistent and **v**ery **b**io-accumulative substances. The authorization refers solely to those applications for which authorization is applied for and for which proof is furnished that there are no unacceptable risks.

Up to now, the public agencies have the burden of proof to show on the basis of test documentation that a substance, when used for its designated purposes, generates an unacceptable risk for man or the environment. This is soon to change. The future introduction of an authorization procedure that is linked to a time schedule and reverses the burden of proof for particularly hazardous substances in contrast to the former procedure of bans on use and restrictions will be an effective and efficient instrument for the management of chemical substances. The challenge will be to identify particularly hazardous substances at an early stage and to handle these as quickly as possible.

The flame retardants example

The example of halogenated flame retardants in plastic products illustrates how difficult risk management for substances can be within the current legislative framework. Flame retardants are widely used: in computer and TV set enclosures, in electric circuit boards or in insulating materials and foams. On the

Table 6: Registration and evaluation of substances in the REACh system

Annual marketing quantity	Information	Registration	Time scale	Evaluation of the information submitted by authorities	Time scale
1–10 t	Reduced data set: Physical/chemical data, eco-toxicity, toxicity, in-vitro tests when possible	Approx. 30,000 substances: Statutory data required, including proposals for classification and labelling, data on use and exposure, safety data sheets, preliminary risk assessment, proposed risk management measures	By 2012	Substances with hazardous properties (e.g. persistent, bio-accumulating, mutagenic) as well as substance-specific test programmes, when applicable	
10–100 t	Basic data set, Appendix VII A to Council Directive 67/548 EEC		By 2012		
100–1,000 t	Stage-1 tests according to Appendix VIII to Council Directive 67/548 EEC based on substance-specific test plans		By 2008	Approx. 5,000 substances: Development of substance-specific test programmes	By 2012
>1,000 t	Stage-2 tests according to Appendix VIII to Council Directive 67/548 EEC based on substance-specific test plans		By 2005		By 2010

one hand, these substances also help protect consumers. However, they also belong to a toxicologically and ecotoxicologically very problematic group of substances on the other. Halogenated flame retardants have been detected by analytical methods both in the environment and in organisms: apart from their (eco)toxic action, they also have a persistent and bio-accumulating effect.

A study conducted on behalf of the Federal Environmental Agency (UBA) set up profiles for thirteen flame retardants in terms of their environmentally relevant characteristics, ecotoxicity, toxicity and recycling capability, and developed recommendations for action on this basis [56]. Table 7 (page 86) is a synopsis of these evaluations.

As already mentioned, lack of data is still a common reason for the inadequate substantiation of risk assessments. This applies to almost one third of the substances on group IV. In the case of group I to III substances, sufficient data is, however, available in order to either recommend a restriction of use or advocate complete substitution. Although far-reaching possibilities exist for substitution with less problematic substances or for modifying the technical design of the relevant products, there are still serious obstacles to use, mostly of a commercial nature.

Within the scope of the EU Directive on Existing Substances, some of the group I to III retardants were subjected to risk assessment. The vast amount of time and the relatively complex work required for these tests prevented a quick implementation of rules for the substances in question. Due to the reference to the evaluation process that was underway, it turned out to ensure the status quo for producers and uses, at least on a temporary basis. A general ban on

the use of penta-bromodiphenyl ether (PentaBDE) was launched in 2001. A proposed 24th amendment to Council Directive 76/769/EEC on the Restrictions on the Marketing and Use of Certain Dangerous Substances and Preparations has been tabled. Although the evaluation of another two substances, i.e. OctaBDE and DecaBDE, has been largely concluded, risk reduction strategies are not yet in place in order to counter the identified hazard that results from the accumulation of these substances in the food chain.

The elements and tools of a new EU chemical substances policy which are currently under discussion can speed up the process in this case and hence act as a tool of preventive consumer and environmental protection.

The EU Commission plans to present the new draft chemical legislation during the course of the year 2002. Since October 2001, experts from the member states, industry associations and other non-governmental organizations, headed by the EU Commission, have been working on the further development and on more concrete definitions of the proposals contained in the white paper. UBA is actively involved in this discussion with a focus on the following issues:
(IV 1.1, III 1.4)

Long-distance propagation of substances

The risk potential of a substance was up to now generally defined on the basis of a comparison of its measured or estimated concentration in the environment and its effect on different organisms.

At a limited local level, this conventional estimate is still a very reliable approach. However, years of experience with the assessment of chemicals suggest that this concept often underestimated the environmental risks in a larger geographical and historical context. This is particularly true for substances which are not eliminated at all or at a very low rate only and which additionally accumulate in organisms. This does not even mean that these substances must be particularly volatile. The dynamic forces of the atmosphere or oceans are sufficient to distribute these substances all over the world. These substances can then accumulate and develop their toxic effects, in particular, in the earth's polar regions and in the organisms living there.

Since substances that contain these properties endanger the environment everywhere on earth, the international community repeatedly advocated measures aimed at preventing the release of these substances in future. International conventions, such as the 1998 *POP Protocol* of the UN Economic Commission for Europe (UN-ECE) and the 2001 *POP Convention (Stockholm Convention)* of the Economic Programme of the United Nations (UNEP) target banning substances with these characteristics or at least restricting their use to a substantial extent. Further aims include the prevention of the development and release of new POPs. This will require suitable methods in order to forecast the long-distance propagation potential of such substances.

Table 7: Summary of evaluations of flame retardants

I	*Discontinuation of use*	*Decabromodiphenylether* *Tetrabromobisphenol A, additive*
II	*Reduction sensible, substitution*	*Tetrabromobisphenol A, reactive* *Tris(chloropropyl) phosphate*
III	*Problematic properties* *Reduction sensible*	*Hexabromocyclododecane* *Sodium borate-decahydrate (Borax)* *Antimony trioxide*
IV	*No recommendation possible due to data deficits*	*Bis(pentabromophenyl)ethane* *Resorcinol-bis-diphenyl phosphate* *Pyrovatex CP new* *Melamine cyanurate*
V	*No objections to use*	*Red phosphor* *Ammonium polyphosphate* *Aluminium trihydroxide*

Within the scope of the Environmental Research Plan (UFOPLAN), UBA has commissioned the development of a mathematical simulation model which supplies information about this parameter. The multi-media model termed ELPOS (**E**nvironmental **L**ong-range Transport and **P**ersistence of **O**rganic **S**ubstances) enables an estimate of the relative environmental persistence and of the long-distance propagation potential of substances on the basis of a comparison to known POPs. [57].

The applicability of multi-media models was discussed at an international meeting of experts in Ottawa, Canada, organized by the Organization for Economic co-operation and Development (OECD) together with UNEP. The participants recommended using this approach to identify and evaluate potential POP or PBT substances. In this way, measures can be taken in time in order to prevent world-wide distribution.

(IV 2.2)

Authorization procedures for biocides

The Federal Ministry for the Environment (BMU) is the leading institution in the national legislation process for the implementation of the *EU Biocide Directive (Directive 98/8/EC Concerning the Placing of Biocidal Products on the Market)* of 16 February 1998. Rather than being enacted as an independent law, this directive will be supplemented by administrative provisions and integrated into the existing Chemicals Law (ChemG). This intention pursued with this decision is to prevent a further disintegration of the law on substances and materials.

When this revised Chemicals Law comes into effect in mid-2002, this will not only close an important gap in German law on substances and materials, but will also create an authorization procedure for biocidal products whose central elements will then be harmonized at EU level. This will mark an important step towards improving environmental and consumer protection through greater safety of chemical substances.

Within the scope of the administrative regulations for biocidal substances and products, the following ordinances will be the first to be developed:

- An article ordinance with the following elements: a new *biocidal authorization ordinance* setting forth details for the authorization process, the necessary modifications of the ordinance on hazardous substances with a view to the classification and labelling of biocidal products, information concerning correct use, as well as the integration of biocidal products into the system of the ordinance on toxic-substances information.
- A chemicals cost ordinance setting forth the fees for processing applications with the aim of charging fees which cover the actual costs to the maximum extent possible.

Further regulations with more details based on the powers laid down in the revised Chemicals Law will be enacted in a subsequent legislative process.

The authorization body pursuant to the Chemicals Law at the Dortmund-based Federal Institute for Occupational Safety and Health (FIOSH) will also serve as the new authorization body for biocides. It will decide on the approval of biocides on the basis of consultations with several other Federal agencies, for example,

- with UBA on environmental protection aspects
- with the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV) on aspects of consumer protection
- with the FIOSH on aspects of workers' health protection.

Since biocidal products are used for an extremely wide range of applications, the special expertise of further agencies will be drawn on in certain cases. The Federal Biological Research Centre for Agriculture and Forestry (BBA) will be consulted with regard to active substances which are also used in plant protection agents, the Federal Institute for Materials Research and Testing (BAM) with regard to material protection agents, and Robert Koch-Institut (RKI) for disinfectants. Exceptions to these consultation rules are possible if unforeseen hazards have to be tackled. In the case of epidemics, for example, the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV) or the Robert Koch-Institut can assume responsibility for the authorization of pesticides or disinfecting agents.

Outlook

Working groups with experts from different EU countries are working, with UBA's participation, on the preparation of technical guidelines for including bio-

cidal substances into **APPENDIX I** of the *EC Biocidal Directive* and for the authorization of biocidal products. Parallel to this specific support work on the interpretation of the directive, the existing *Technical Guidance Document* for assessing the risks of existing and new substances (TGD) [58] will also be fundamentally revised and amended. The aim is not just to integrate adaptation rules for existing and new substances which result from the experience gained with risk assessments in recent years. This effort also aims to integrate the specific aspects of biocide assessments. UBA experts are participating in all the work groups involved. The revised TGD will be another, important step on the road towards a harmonized evaluation approach for all chemical substances within the European Union [59]. *(IV L)*

Appendix I: *Appendix I to the EC Biocidal Directive is an EU-wide, uniform list of active substances that may be contained in biocidal products for particular applications. Registration of an active substance in this appendix is a precondition for the authorization of products containing this substance.*

[53] Commission of the European Communities: White Paper on the Strategy for a Future Chemicals Policy, COM(2001)88, available on the Internet at europa.eu.int/comm/environment/chemicals/whitepaper.htm

[54] "Nachhaltigkeit und Vorsorge bei der Risikobewertung und beim Risikomanagement von Chemikalien" [Sustainability and prevention in conjunction with risk assessment and risk management for chemicals] (TEXTE 30/01), available from Werbung + Vertrieb (address on page 90).

[55] Available on the Internet at ue.eu.int/newsroom/main.cfm?LANG=1

[56] "Erarbeitung von Bewertungsgrundlagen zur Substitution umweltrelevanter Flammschutzmittel" [Development of evaluation criteria for substituting environmentally relevant flame retardants I, II und III (TEXTE 25/01, 26/01 and 27/01), available from Werbung + Vertrieb (address on page 90)

[57] The ELPOS model can be downloaded from the server of Universität Osnabrück at www.usf.uni-osnabrueck.de/projects/elpos.

The final report for the research project titled "Kriterien für das atmosphärische Ferntransportpotenzial und die Persistenz von Pflanzenschutzmittelwirkstoffen und Industriechemikalien" [Criteria for the atmospheric long-range transport potential and the persistence of active substances in plant protection agents and industry chemicals" is available on loan from UBA's library under number UBA-FB 000248 (address on page 2).

Further up-to-date information on POPs can be found on the Internet at irptc.unep.ch/pops.

[58] Technical Guidance Document in Support of Commission Directive 93/67/EEC on Risk Assessment for New Notified Substances and Commission Regulation 1488/94 on Risk Assessment for Existing Substances Official Publications of the EC, Luxembourg 1996, ISBN 92-827-8013-9.
[59] The latest version of the technical guidelines on the EC Biocidal Directive is to be found on the homepage of the European Chemicals Bureau of the EU Commission at ecb.ei.jrc./biocides.

The Federal Ministry for the Environment provides information on the state of the implementation of the directive on its homepage at www.bmu.de under the keywords "Current Topics", "Environment and Health", "Biocides".

For further information, above all, on technical issues, please refer to the authorisation unit at the Federal Institute for Occupational Safety and Health (FIOSH) at www.baua.de/amst/biozid.htm.

Part 2

Project results, data and news

Division I: Environmental planning and environmental strategies

Department I 1:

Environmental strategies and environmental information

Environmental Research Plan (UFOPLAN)

The Environmental Research Plan (UFOPLAN) by the Federal Ministry for the Environment (BMU) includes the need for research derived from the different tasks in the fields of environment, nature conservation, as well as reactor safety and radiation protection. The key aspects of the projects assigned by the Federal Environmental Agency (UBA) – in rounded percent figures of UBA's overall research budget managed in 2001 – can be seen in Figure 11 *(I 1.1)*

Advisory aid for central and eastern Europe and the New Independent States

The Federal government's advisory aid programme for environmental protection in central, eastern and south-east Europe and in the New Independent States (NIS) was established in 2000. Germany is thus helping EU candidate countries in central and eastern Europe as well as the successor states to the Soviet Union to implement EU environmental legislation and to bring their environmental standards in line with those of the EU. These projects are handled by UBA – both at an expert and administrative level. On the whole, subsidies in 2001 totalled around 1.5 million. Figure 12 illustrates how the funds are distributed according to key aspects.

Key aspects were:

- Support during the implementation of EC directives
- Preparation of the technology and know-how transfer for plant safety and efficient energy use
- Promotion of regional co-operation via the Regional Environmental Center for Central and Eastern Europe in Szentendre (Hungary) and the Baltic Environmental Forum in Riga (Latvia).

(I 1.2)

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

Environmental protection aid for central and eastern Europe and the New Independent States

Coming in line with the EU means considerable investment for the candidate countries of central and eastern Europe. The EU Commission estimates these figures for environmental issues at more than 120 billion. A growing demand for investment can also be expected for the New Independent States (NIS). In order to ensure that German support services are targeted correctly, Ecologic gGmbH, Berlin, has analysed and evaluated on behalf of UBA the subsidy and financing policy of western funding facilities and international financing institutions. This sub-contractor also evaluated the methodology employed by the Organization for Economic Co-operation and Development (OECD) when deciding on the financing of environmental protection projects. This methodology has already been successfully used for municipal water supply and waste-water treatment in Georgia and

Moldavia as well as in the Russian regions of Novgorod, Pskov and Kaliningrad.

The research report is available on loan from UBA's library (address on page 2) under number FKZ 299 19 154. (I 1.2)

Partnership projects with candidate countries

UBA supports BMU in the implementation of the EU TWINNING PROGRAMME. This programme promotes the adoption of EU legislation and the establishment of effective administration structures in candidate countries – on the basis of close partnership with one or more member states. Figure 8 provides an overview of the projects that have been carried out up to now by the member states in the different political fields. Germany has a key role to play, particularly in the field of environmental issues.

In 2001, a host of twinning projects in which UBA was involved were completed. Table 9 offers an overview of the partner countries, the respective environmental sectors as well as the topics dealt with.

The final reports are available in English on the Internet at: www.umweltbundesamt.de, English pages, under "Facts and Figures". (I 1.2)

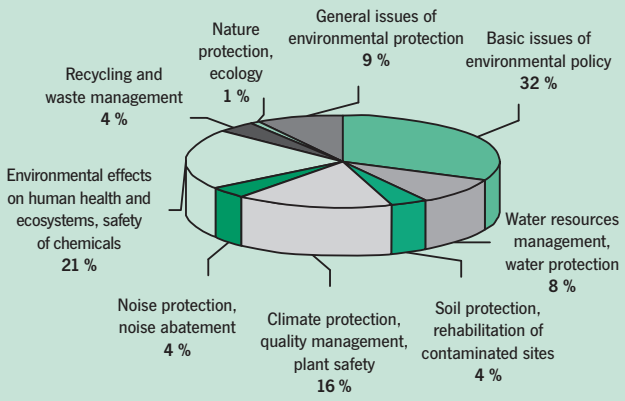
Agenda 21 in European sea ports

In 1998, the foreign ministers of the Baltic Sea states adopted an agenda to promote the sustainable, i.e. lasting, environmentally compatible development of the Baltic Sea area (BALTIC 21). This agenda covers eight sectors: energy, education, fisheries, industry, agriculture, tourism, transport, forests as well as regional planning.

As part of the German contribution to BALTIC 21, UBA started a project titled "Implementation of Agenda 21 in European sea ports based on the example of Lübeck-Travemünde". The aim of the project is to analyse the environmental burdens caused by ships and ferries in ports and to develop measures and instruments designed to reduce these burdens. The opening event was held on 6 November 2001 in the "Roter Saal" of Lübeck's town hall.

Further information on this project is available on the Internet at: www.luebeck2000.de. Information on the action programme of the Agenda BALTIC 21 is available at: www.ee/baltic21. (I 1.2)

Figure 11: Key aspects of UBA's 2001 research budget



Indicators for sustainable tourism in the Baltic Sea region

As part of the German contribution to the work programme by the tourism work group of the Agenda BALTIC 21, UBA commissioned the Kiel-based research institute, Institut für Tourismus- und Bäderforschung in Nordeuropa (NIT), to draft "Indicators for the development of sustainable tourism in the Baltic Sea region". Within the scope of this work, funda-

Figure 12: Distribution of subsidy funds for the advisory aid programme in 2001 according to key aspects

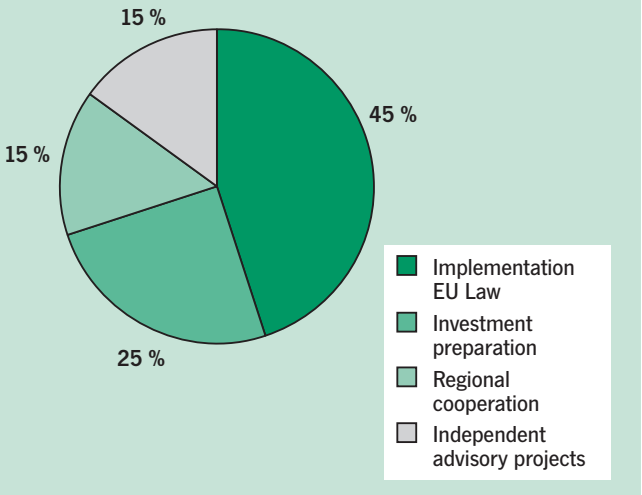


Table 8: Twinning projects (as project leaders) per member state, broken down according to sectors

Department	A	B	D	DK	E	FIN	F	GR	IRL	I	NL	P	S	UK
1. Agriculture			20	2	5	1	11	2		5	8		2	4
2. Environment	4	1	17	2		2	6		1	1	2		2	1
3. Structure funds			5	1	6	3	7	2	2	1				9
4. Social policy	3		3	4	3		5				3		6	4
5. Public finance and internal market	2		13	2	9	4	23		1	5	2		11	12
6. Justice and domestic policy	4		24	1	12	5	7	1		2	2		2	10
7. Administration				1	1	1	2							1
8. Transport, energy and telecommunications				3	3		2				1		2	2
9. Others	1		3	1	3	3	4			1	1		1	
Total	**14**	**1**	**85**	**17**	**42**	**19**	**67**	**5**	**4**	**15**	**19**	**0**	**26**	**45**

Source: National Contact Point at the Federal Ministry for Finance

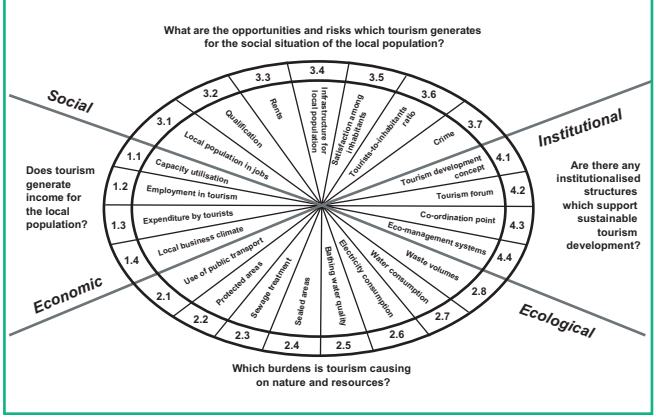
mental aspects of tourism in the Baltic Sea states – such as employment in tourism and bathing water quality – were looked into and sustainability indicators were examined with a view to their suitability. The indicators were selected in co-operation with representatives from the tourism industry in order to ensure that they can be applied on a local level and accepted and used as tools in practical application (Figure 13).

The proposed indicator matrix contains 23 core indicators and 15 additional indicators that encompass ecological, economic, social and institutional aspects of sustainability.

The study titled "Indikatoren für die Entwicklung von Nachhaltigem Tourismus im Ostseeraum" [Indicators for the Development of Sustainable Tourism in the Baltic Sea Region] (TEXTE 68/01) is available from Werbung + Vertrieb (see box on page 90).

(I 1.2)

Figure 13: Indicators for the development of sustainable tourism in the Baltic Sea region



Co-operation with the European Environment Agency

The European Environment Agency (EEA) supplies the EU Commission and the member states with the latest, targeted and reliable information on the environment that is relevant from a European point of view. In 2001, the EEA published its second indicator report as well as the second report on the integration of transport and the environment in the EU based on indicators. Furthermore, it also tabled a comparative study on data and information supply by the EEA members countries on the subjects of air, water, waste and nature conservation from 31 European states. In this study, Germany's involvement in the European Environmental Information and Observation Network (EIONET) ranked 4th and was hence higher than the year before.

Table 9: Overview of the partner countries and key topics of twinning projects completed in 2001 with the involvement of UBA

Candidate country	Twinning partner	Area	Subjects
Romania	Germany	Waste management	- Adoption of EU regulations - National waste strategy and national plan of action for waste - Structures for the efficient provision of waste management data - PR work concepts - Co-operation between central, regional and local authorities, as well as with industry, retailing trade and other parties concerned
Czech Rep.	Sweden Netherlands Denmark Germany	Development of institutional capacities in the environment sector	- National strategy for the implementation of environment law - International co-operation - Further training programmes, teaching materials - IT networking in administrations - Quality assurance during inspections
Slovenia	Austria France Germany	Development of institutional capacities in the environment sector	- Guideline for the adoption and enforcement of EU legislation concerning air - National emission inventory system, data gathering and reporting - Strategy for reducing greenhouse gas emissions
Estonia	Finland Germany	Air quality management	- Emission inventory on the basis of a database for documenting emission development - Air quality measurement and assessment methods - Dispersion models in addition to measuring methods
Bulgaria	France Austria Germany	Environment strategy Environment action programme	- Legislation concerning water protection and air quality management, air measuring network - Biodiversity regulations, register of protected areas - Electroscrap and used-vehicles regulations - Rehabilitation of contaminated sites - Environmental damage assessment manual - Environmental education
Slovakia	Germany	Communal waste management	- Waste management plan, waste forecast, Waste data - Concept for households for selective collection - Technologies for the disposal of settlement waste - Adoption of EU legislation on landfills - Stock-taking for landfills, closing-down and upgrading plan - Financing and information plans

The report titled Environmental Signals 2001 (Environmental assessment report 8) is available from bookstores (ISBN 92-9167-271-8), as is the indicator report TERM 2001: Indicators tracking transport and environment integration in the European Union (Environmental issues series 23), ISBN 92-9167-307-2). Comprehensive information concerning the EEA can be found on the Internet at: www.eea.eu.int.

Scientific publications

In 2001, UBA once again issued over 90 scientific publications (BERICHTE series: five titles, TEXTE series: 83 titles – five of which are also available on CD-ROM – as well as 26 titles outside the UBA series. This development can be seen in Figure 14 (page 95).

"Bestsellers" in 2001 included:

- The 2000 Annual report (on paper and CD-ROM)
- Travel guide "Zu den Böden Deutschlands" [To the soils of Germany]
- Nachhaltige Wasserversorgung in Deutschland – 'Analyse und Vorschläge für eine zukunftsfähige Entwicklung [Sustainable water supply in Germany – Analysis and proposals for future-enabled development]
- 2001 Environmental Declaration for the Bismarckplatz 1 location
- Mobility management in order to overcome municipal transport problems
- A Selection of Recent Publications (Vol. 6)

Information literature

In 2001, UBA once again issued a wide range of new information literature. The following brochures and leaflets were some of the most popular:

- Umweltdaten Deutschland – Farbfolienserie zum Umweltschutz [Environmental Data for Germany – Colour slide series on environmental protection]
- Leaflet titled "Möbel für gesundes Wohnen?" [Furniture for healthy living?]
- Leaflet titled "Auto und/oder Umwelt?" [Car and/or environment?"]
- Leaflet titled "Klimaschutz 2001" [Climate Protection 2001]
- Leaflet titled "Klimaänderung: Ein wissenschaftlicher Popanz?" [Climate change – a scientific spook?"
- Brochure titled "Ohne Wasser läuft nichts – Ausgabe 2001" [Nothing works without water – 2001 edition]

Executive Director of the European Environment Agency visits UBA

In November 2001, Domingo Jiménez-Beltran, executive director of the EEA, visited UBA in order to inform the national EIONET partners about the re-organization of the EEA.

This visit served as a useful opportunity to discuss Germany's contribution to EEA activities, such as the supply of data and information by the German EIONET partners, the role played by the contact offices during the concept work performed by the EEA, as well as the contribution by the German partners to the European Topic Centres (ETCs). *(I 1.2)*

International visitors

In 2001, around 260 foreign guests came to visit UBA. The majority of these visitors came from China and Japan, with visitors also coming from Algeria, Bulgaria, Chile, Ecuador, Greece, Hong Kong, India, Indonesia, Jordan, Kazakhstan, Kenya, Columbia, Korea, Mexico, Peru, Poland, the Czech Republic, the Ukraine and Vietnam. These guests – primarily politicians, business people and researchers – came to UBA in order to find out about environmental protection in Germany, to discuss related issues with the experts at UBA and to acquire inspiration and support for their own projects. Interest often focused on the following topics:

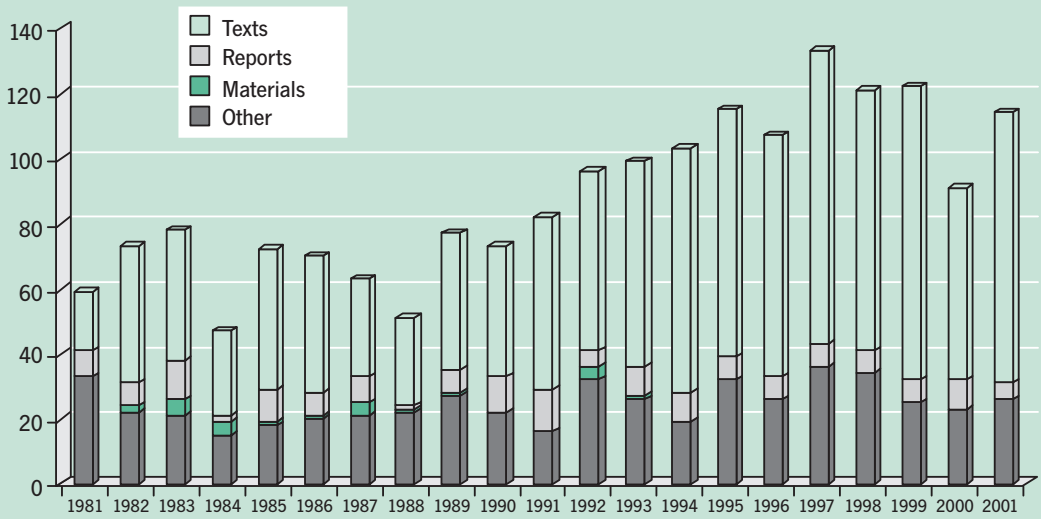
- UBA's organizational structure and role
- Environment and transport
- Air quality management, environment and legislation as well as waste management

(I 1.2)

Visitor service

Once again in 2001, a large number of groups from Germany visited UBA to find out more about the work carried out by this agency. Almost 1,500 school goers, students and others interested in politics visited the new multi-vision show "Das Umweltbundesamt – für Mensch und Umwelt" [The Federal Environmental Agency – for Humanity and Environment] and discussed topical environmental issues with scientific staff. *(I 1.3)*

Figure 14: Development of publications



Boosting regional marketing

UBA is promoting a co-operation project by Naturschutzbund Deutschland (NABU) [German Nature Conservation Organization] and Deutscher Verband für Landschaftspflege (DVL) [German Association for Landscape Conservation] that aims to boost regional marketing and help the work carried out by regional initiatives. The aim of this project is to achieve greater awareness of regional marketing both in the field of politics and among the general public. In autumn 2001, NABU and DVL submitted a measures catalogue to boost regional circulations and to promote regional initiatives that operate in an environmentally compatible manner.

A magazine titled "RegionalPost" is also being issued as part of this project. This magazine offers comprehensive information on the activities underway and offers. Further information on the "RegionalPost" co-operation project and the measures catalogue from DVL and NABU is available on the Internet at: www.reginet.de. *(I 1.4)*

Supply of environmental data by Eurostat

The work carried out by EU Statistical Office (Eurostat) on environmental statistics focuses on gathering and publishing data concerning the burden on the environment caused by human activity as well as the economic and social response to changes in the condition of the environment. Besides classical environmental statistics, Eurostat is also involved in developing indicators and in environmental-economic accounts.

Eurostat together with the Organization for Economic Co-operation and Development (OECD) carries out regular polls on the condition of the environment in the member states in order to gather data – UBA is responsible for co-ordinating these polls in Germany. The results form one of the main sources of data for environmental and indicator reporting by the EU and OECD and are also made available to other international agencies, such as the EEA and the United Nations Environment Programme (UNEP).

The report published in 2001 by Eurostat titled "Environmental pressure indicators for the EU" is available on the Internet at: www.europa.eu.int/comm/eurostat. *(I 1.5)*

The latest environmental information for the general public

According to international conventions and recommendations, each country must warrant free ac-

cess to the latest environmental information so that the public can be integrated into opinion-forming and decision-making processes concerning environmental policy. In order to provide up-to-date information, in the year under survey, UBA introduced a catalogue of environmental topics and the pertinent report sheets. These described the current status quo for each of the respective topics and provided the related data and framework information. The topics of the "Daten zur Umwelt 2000" report [Environmental data 2000] served as the starting point.

The report sheets can be viewed on the Internet at: www.umweltbundesamt.de. *(I 1.5)*

Indicators for sustainable development

The Heidelberg-based ifeu institute – Institut für Energie- und Umweltforschung – is carrying out on behalf of UBA a research project on "Key indicators for sustainable development". The aim is to create the foundation for transparent and easy-to-understand reporting on the status of sustainable development in Germany. For this purpose, a set of status-orientated indicators with 60 to 80 items, as well as indicator sets for key aspects of the national sustainability strategy, i.e. "Environmentally compatible mobility", "Climate protection and energy", and "Environment, health and food", were developed.

In 2001, the structure was defined for the indicators. This structure is not based on the pillar model of sustainable development with its separate documentation of ecological, economic and social aspects, but instead is based on viewing the fields of human need – such as mobility, health, living – in conflict with ecological capacity.

Furthermore, existing sustainability goals were also assigned to the selected sustainability topics. Defined goals are required in order to be able to asses whether development is in line with the sustainability concept (going in the right direction). In addition to this, communication on sustainable development is simplified.

The report on indicator structure is available from UBA's unit I 1.5 "National and international environmental reporting" (address on page 2).
(I 1.5)

Department I 2:

Legal, economic and sociological issues related to the environment; energy and climate protection

Legal protection in the environmental sector

German judicial legal protection is soon to face new challenges in the environmental sector. This primarily involves extended possibilities to file action. In light of this, Prof. Dr. Astrid Epiney, Freiburg University (Switzerland), has carried out a research project on behalf of UBA. This study sums up and compares legislation governing legal protection in Germany, France, Great Britain, Denmark and Italy. Moreover, existing requirements for legal protection under international, EU and constitutional law are analysed and conclusions are drawn for future provisions.

"Zugang zu Gerichten und gerichtliche Kontrolle im Umweltrecht – Rechtsvergleich, völker- und europarechtliche Vorgaben und Perspektiven für das deutsche Recht" [Access to courts and judicial control in environmental law – Legal comparison, requirements under international and European law and perspectives for German legislation] (BERICHTE 01/02) is published by Erich Schmidt Verlag, Berlin, and is available from bookstores (ISBN 3-503-06627-6)
(I 2.1)

Environmental liability

Environmental liability is an instrument of environmental protection that acts both on a preventive level and ensures compensation for environmental damage on the part of the causer. In order to sound out opportunities for improving environmental liability, Prof. Dr. Juliane Kokott, St. Gallen University (Switzerland), together with Dr. Frank Hoffmeister, carried out a research project on behalf of UBA. The study analyses the current situation with regard to liability for environmental damage in Germany under public law. This will help to create standardized liability law for damage to the environment. In addition to this, the study also deals with issues related to national liability regulations for environmental damage in areas under no national sovereignty.

The study titled "Public-law compensation for environmental damage in Germany and in areas under no national sovereignty – Stock-taking, legal compar-

ison and proposals de lege ferenda" (BERICHTE 09/02) is published by Erich Schmidt Verlag, Berlin, and available from bookstores. (I 2.1)

Environmental offences

41,152 environmentally relevant offences were recorded in 2000 (1999: 43,382; 1998: 47,900; 1997: 46,004 foffences). This marks a continuation of the decline in environmental crime that was first noted in 1999 (in 1998 by 3.8 %; in 1999 by 11.4 %) – with a declining rate of 5.1 %.

These figures were taken from evaluations by the Bundeskriminalamt (BKA) [German Federal Office of Investigation] and the Statistisches Bundesamt (StBA) [Federal Statistical Office] which prepared a nation-wide comparison of environmentally relevant crime statistics on the basis of data from the German Federal-state offices of investigation and the Federal-state statistic offices (Figure 15).

34,415 crimes as defined in sections 324 to 330 a of the *German Penal Code (StGB)* were registered in 2000. This figure was down 6.1 % compared to the previous year.

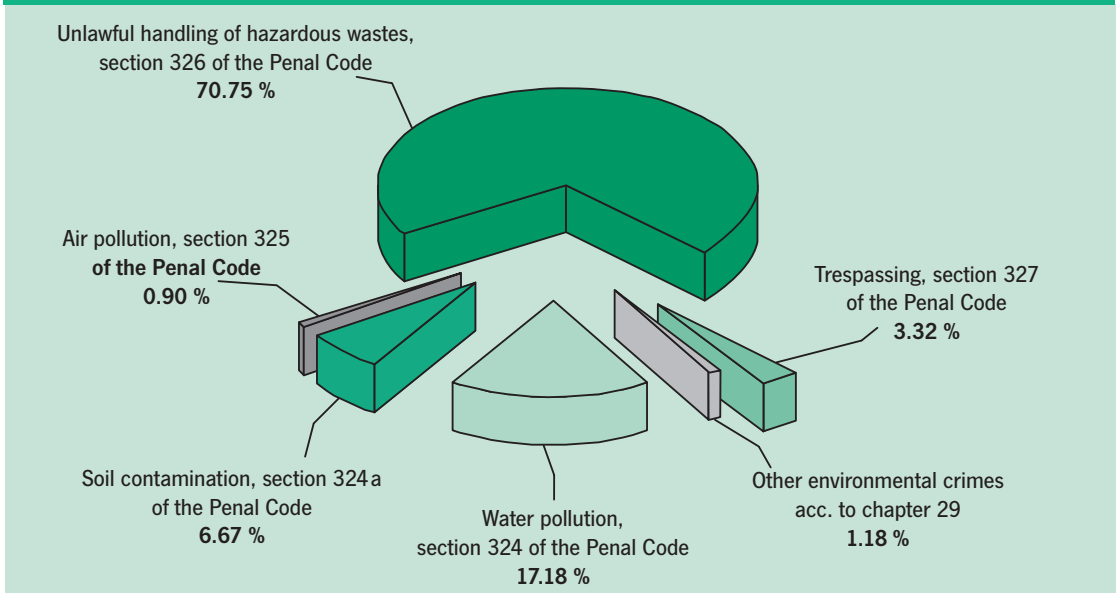
The clear-up rate for the entire country rose compared to the previous year (just under 59 %) to 61 %. Saxony-Anhalt recorded the highest clear-up rate with 83.7 %, followed by Bavaria (79.7 %) and Saarland (78.6 %). Berlin with its 28.2 % recorded the lowest clear-up rate. *(I 2.1)*

Comparing the external costs of electricity generation

Various studies over the past fifteen years show that the external costs of electricity generation from regenerative energy sources are significantly lower than the external costs of conventional electricity generation which is usually replaced by the use of regenerative energy sources. External costs are understood here particularly as the costs of environmental damage caused by air pollutants as well as the costs of the subsequent climate change. Against this background, the *Act on the Sale of Electricity to the Grid* was adopted in 1990 and was then replaced by the *Renewable Energy Sources Act* in 2000. Both of these laws try to create a balance for the difference in the different (conventional and regenerative) energy sources that is not considered in the external costs without quantifying this difference in detail.

On behalf of UBA, Prof. Hohmeyer from Flensburg University drafted a report that attempts to calculate the actual difference in external costs between electricity generation from different regenerative energy sources and the substituted electricity generation from conventional energy sources and to find reasons for these differences.

Figure 15: Environmental crimes in Germany in 2000



The report came to the conclusion that the overall economic savings achieved with the various renewable energy sources were significantly higher than the payments to electricity suppliers guaranteed under the Renewable Energy Sources Act (except in the case of photovoltaic installations). The author even considers that the payments for water, wind and biomass must be developed further and corrected.

The analysis ultimately shows that today's demand for renewable forms of energy is in fact justified.

The study "Vergleich externer Kosten der Stromerzeugung in Bezug auf das Erneuerbare-Energien-Gesetz" [Comparison of the external costs of electricity generation in relation to the Renewable Energy Sources Act] (TEXTE 06/02) is available from Werbung und Vertrieb (see box on page 90). (I 2.1)

International trade in agriculture and services I

At the beginning of 2000, negotiations by the World Trade Organisation (WTO) started on the further liberalization of international trade in agriculture and services. This had already been determined when the WTO was established in 1995.

International trade in agriculture has a host of different impacts on the environment and health as well as on food safety. A new study looks into which areas of the WTO agreements – in particular, the agreement on agriculture – should be adapted in order to ensure adequate protection of the environment and health and to achieve the goals of food safety.

The study titled "Umwelt- und Ernährungssicherheit in den laufenden WTO-Agrarverhandlungen" [Environmental and food safety in the current WTO negotiations on agriculture] is published in the TEXTE series and available from Werbung + Vertrieb (see box on page 90). (I 2.2)

International trade in agriculture and services II

Under the motto "To who's benefit? – The General Agreement on Trade in Services (GATS) and its consequences for sustainable development", an international conference was held in Bonn, Germany, on 21 and 22 May 2001. In view of the many services sectors affected by the GATS and the far-reaching possibilities for intervening in national and municipal regulatory areas, the aim was to promote expert and political exchange on the impacts of the GATS on sustainable development. The international conference and two other studies form part of a three-year research project titled "Integration of environmental and sustainability aspects into the new WTO negotiations" that is being carried out by the "Environment and Development" forum in Deutscher Naturschutzring (DNR) in Bonn.

The documentation "Zu wessen Diensten?" – Das Abkommen zum internationalen Dienstleistungshandel (GATS) und die Folgen für eine nachhaltige Entwicklung" [To who's benefit? – The General Agreement on Trade in Services (GATS) and its consequences for sustainable development] (TEXTE 82/01) is available from Werbung + Vertrieb (refer to box on page 90). The study on "Implications of the General Agreement on Trade in Services and other GATS negotiations for environmental policy" is also available here in English and German. (I 2.2)

EU environmental aid framework hinders progressive environmental protection

At the beginning of February 2001, the EU Commission adopted a new Community framework for public environmental aid. A study carried out on behalf of UBA by the Finanzwissenschaftliche Forschungsinstitut (FiFo) at Cologne's university comes to the conclusion that the framework for environmental aid has significant shortcomings:

- It hinders innovative environmental policy in the member states that goes beyond the legal requirements of the EU and discriminates against integrated environmental protection technologies.
- Within the scope of aid control, the Commission intervenes in the instrumentation and implementation of national environmental policy in such a manner that it oversteps its competence which can be or is justified for reasons of competitive or economic policy.
- At the same time, the new Community framework completely fails to reinforce protection for competition.

The study " The European Aid Supervision in Environmental Protection" (TEXTE 01/02) is available from Werbung+Vertrieb (refer to box on page 90).
(I 2.2)

Environmental controlling in the private sector ...

Environmental controlling is an important contribution to the ongoing planning, steering and control of environmental management. In order to offer assistance here, the Federal Ministry for the Environment (BMU) and UBA have revised the "Handbuch Umweltcontrolling" [Environmental Controlling Manual] that was first issued in 1995. Around 50 authors from business and science thoroughly revised, updated and supplemented the manual that is primarily destined for small and medium-sized enterprises. This second edition offers 700 pages of information with everything that a company needs to know in order to establish environmental controlling.

The "Handbuch Umweltcontrolling" [Environmental Controlling Manual] is published by Vahlen-Verlag, Munich, and available in bookstores (ISBN 3-8006-2536-9). *(I 2.2)*

... and in the public sector

Authorities and other public institutions have had a lesser role to play up to now in the discussion on sustainable development and during the fulfilment of national environmental goals. However, not just due to their role model function, but also due to their environmental relevance and the impact which the wasteful use of natural resources can have on costs, the public sector must also do more for environmental protection. Surveys have shown that the public sector has a significant ecological and economic potential for savings. Environmental controlling has a key role to play here. This is why the BMU and UBA have issued the "Handbuch Umweltcontrolling für die öffentliche Hand" [Manual on Environmental Controlling for the Public Sector] (Figure 16) . This manual is designed to encourage and motivate public authorities and other public institutions to promote environmental protection. This manual can also offer advice during the introduction of an environmental management system. Many practical examples, tips and additional information provide users with effective support.

Figure 16: Cover page of the manual

The "Handbuch Umweltcontrolling for the Public Sector" [Environmental Controlling Manual for the Public Sector] is published by Vahlen-Verlag, Munich, and is available at bookstores (ISBN 3-8006-2727-2). Extracts for reading, a host of links and downloads can be found on the Internet at: www.umweltbundesamt.de. *(I 2.2)*

Corporate environmental cost management

With the help of corporate environmental cost management, companies can systematically determine those measures that reduce the burden on the environment and also boost their competitive strength. The "Leitfaden Betriebliches Umweltkostenmanagement" [Corporate Environmental Cost Management Guideline] that was jointly issued by the BMU and UBA shows just how this works. This guideline was prepared by the Institut für Ökologische Wirtschaftsforschung (IÖW), Berlin, the Institut für Management und Umwelt (IMU), Augsburg, and the Borderstep-Institut für Innovation und Nachhaltigkeit, Berlin.

The "Betriebliches Umweltkostenmanagement" [Corporate Environmental Cost Management] guideline is available free of charge from UBA's Central Services Unit (see box on page 90). *(I 2.2)*

The environment and financial services

In view of the economic importance of financial services (banks, savings banks and insurance companies), their environmental and social responsibility is increasingly being questioned. On an international

scale, environmental management among Germany's financial service facilities is above-average.

Under the title "Green Finance", the BMU and UBA have tabled a comprehensive analysis of environmental management among banks, savings banks and insurance companies. This represents a cross-section of German finance companies and reflects the development of ecological business in the finance sector in a clear manner. Activities range from environmental sponsoring to environmentally orientated measures for internal and external communication to the establishment of environmental management systems. The analysis also takes a look at the activities of the BMU-UBA "Environment and Financial Services" work group. Comprising around 40 representatives from banks, savings banks and major associations, this work group has been successfully operating since 1997 as an information platform between environmental policy and financial services institutes.

This publication marks a milestone at both national and international level: This is the first time ever that the many different environmental activities carried out by financial institutes have been bundled and documented in one country. The brochure featuring around 80 practical examples is proof that even small steps gradually lead to significant ecological effects.

Free copies of the brochure titled "Green Finance" are available in German and English from the BMU and from UBA's Central Services Unit (see box on page 90). It can also be downloaded from BMU's website at: www.bmu.de. (I 2.2)

Corporate environmental reporting

Since the mid-1980s, a continuous increase in voluntary corporate environmental reporting has been observed. Meanwhile, around 2,500 companies worldwide report on their environmental protection efforts. German companies rank among the leaders in this field, not just in terms of numbers but also in terms of quality. Against this background, co-operation was initiated between UBA's library and the British company Next Step Consulting in London. The aim here is to document all companies reporting on environmental issues in a continuously updated database and to make these environmental reports available to UBA's library. A publication that was issued on this basis by UBA lists all companies that have published an environmental or sustainability report.

Free copies of the publication titled "Global Voluntary Corporate Environmental Reporting" are available free of charge from UBA's Central Services Unit (see box on page 90). The database can also be found on the Internet at: www.corporateregister.com. (I 2.2)

Information on ecological tax reform

The general public is relatively unaware of the principles of action and objectives of ecological tax reform. This is often due to a lack of or incorrect information on its contents, principles of action and objectives. In contrast to the impact of tax burdens, the impact of tax relief that results from the lowering of old-age pension payments as well as the opportunity to benefit from ecological tax reform through energy savings is almost irrelevant.

A new website by the Förderverein Ökologische Steuerreform (FÖS) [Association for the promotion of ecological tax reform] is about to change this. A monthly newsletter will also be available on this website. This initiative is backed financially by the BMU and UBA via the promotion of associations.

The ÖkoSteuerNews [EcoTaxNews] is available on the Internet at: www.foes-ev.de. (I 2.2)

Instruments of regional and urban development policy

The politics pursued by the European Union (EU) are having an ever-greater impact on regional structures and hence on the environmental situation in the member states. This is primarily due to European structure policy and directive competence which the EU has for many regional and environmentally relevant fields of policy. In recent years, special approaches have also been developed for regional development policy. In light of this, it is now necessary to question the extent to which the aims of common environmental policy have already gained access to European regional development policy and the extent to which regional and urban development policy approaches at European level can be used for lasting, environmentally compatible urban and settlement development policy in Germany. Within the scope of the BMU Environmental Research Plan (UFOPLAN), UBA has commissioned a research project that is being carried out by the Dresden-based Institut für ökologische Raumentwicklung (IÖR).

The general documentation of the instruments of EU politics that were examined includes environmental issues, although with different weighting. The European regional development concept EUREK, the action framework "Sustainable urban development" and the Community initiative URBAN II were positively assessed in this context. The concepts for the INTERREG III A and B Community initiatives are orientated more towards player-related aspects of co-operation and have been kept open with a view to considering the environmental dimension. The process-related statements for taking environmental issues into consideration in the Community initiative concepts examined are inadequate. An obligation to consider the protection of natural resources in the implementation process and to design the measures to be promoted as environmentally compatible as possible would be welcomed.

The study "Umweltbelange in raum- und stadtentwicklungspolitischen Instrumenten auf europäischer Ebene" [Environmental issues in instruments of regional and urban development policy at European level] (TEXTE 04/02) is available from Werbung + Vertrieb (see box on page 90) *(I 2.3)*

Sustainable regional planning

In order to co-ordinate the programmes and plans of Federal-state planning with Federal-government authorities pursuant to the *Regional Planning Act (ROG)* that was revised in 1998, UBA issued eleven revised Federal-state, regional and area development plans in 2001 (Figure 17).

The new Regional Planning Act is based on the concept of sustainable regional development where social and economic requirements for the region are brought in line with its ecological functions.

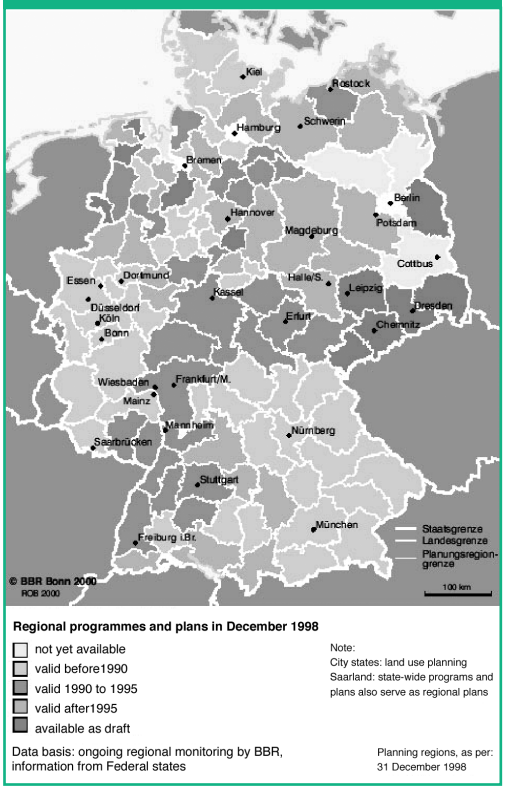
The aims are generally observed, however, when it comes to considering environmental issues and their evaluation, significant differences can be found. What is positive for social discourse, however, is that the data stock, presentation and PR work has been improved considerably – for example, by making plans and programmes available on the Internet. *(I 2.3)*

Environmentally compatible recreation planning

Leisure time and recreation are recognized both socially and legally as indispensable basic functions of existence. Yet growing demands are resulting in increasing conflicts with other forms of use. This is why recreation planning is important in overall regional planning, so that conflicts can be avoided and aberrations can be remedied. Environmentally compatible recreation planning ensures that the protection of nature and landscapes is comprehensively considered, thus warranting the preconditions for mankind's recreation on a lasting basis. In location-related environmental and nature conservation planning, the requirements of recreation planning are – in view of large-scale open-space systems – targeted towards creating a balance between protection needs and user interests in the sense of the sustainable use of space.

A research project has highlighted the link between urban planning and public planning for the basic function of existence "leisure and recreation" with a view to legal, instrumental and implementation strategy. On behalf of UBA, the Akademie für Umweltforschung und -bildung in Europa (AUbE), in Bielefeld, in co-operation with a work group at the faculty of regional planning at Dortmund's university, department for regional planning and Federal-state planning, has devised a target system for environ-

Figure 17: Status of regional planning



mentally compatible recreation planning on Federal-government, Federal-state and municipal level. The planning-policy requirements of the Federal government and national committees were also included in this work.

Based on the conflict fields identified (landscape, agriculture, forestry, location-linked projects in the outdoor area, settlement development, tourism, transport, nature conservation), comprehensive concepts for action and concrete solutions are presented.

The study "Anforderungen einer umweltverträglichen Erholungsvorsorge an die räumliche Gesamtplanung" [Requirements of environmentally compatible recreation for overall regional planning] is available in PDF format on the Internet at: www.umweltbundesamt.de/rup. Further information on regional planning is also available there. (I 2.3)

Guideline for sustainable building

The "Guideline for sustainable building" was issued under the leadership of the Ministry for Building (BMVBW) and in close co-operation with UBA and the BMU. This is a supplementary implementation regulation to the guidelines for the performance of building projects by the Federal government and features a comprehensive view of building, i.e. from demand analysis and area-related planning decisions to object-related measures, from the use phase right through to the recycling and disposal of the building materials. The guideline implements the recommendations for action issued by the Enquete Commission "Protection of man and the environment".

The "Leitfaden Nachhaltiges Bauen" [Guideline for Sustainable Building] is available on the Internet at: www.umweltbundesamt.de/rup. The printed version is also available from Oberfinanzdirektion Hannover, Waterloostr. 5, 30169 Hannover, Germany. (I 2.3)

The latest news with the environmental impact assessment

In 2001, environmental impact assessment legislation was largely revised with the so-called *Article Act* of 27 July 2002. This act brought not just the environmental impact assessment law, but also another 23 Federal laws in line with EU legal requirements. The number of projects which – on all accounts or under certain preconditions – must undergo an environmental impact assessment has been increased significantly. A preliminary examination of the individual case has now been introduced for many projects. This process aims to clarify the issue as to whether a concrete project must undergo an environmental impact assessment. In order to support the authorities during this work, a legal regulation should be developed that sets forth the test criteria defined in the act in greater detail. Preliminary work on this has been underway since 2001. *(I 2.4)*

Transboundary environmental impact assessment

A key aspect of UBA's work in 2001 once again dealt with transboundary environmental impact assessment.

On the one hand, there is the work carried out by the Agency to implement and further-develop the *UN-ECE Convention on Environmental Impact Assessment in a Transboundary Context of 25 February 1991* (*Espoo Convention* of the UN Economic Commission for Europe). This primarily involves further-developing the contents of the Convention itself (amendments) as well as developing tools and recommendations.

The Agency also took part in the ongoing bilateral negotiations with Poland and the Czech Republic on the drafting of agreements for transboundary environmental impact assessment. This work is partially supported by research projects. For example, the planning group Ökologie + Umwelt, based in Hannover, has tested transboundary co-operation within the scope of environmental impact assessment since 1999 within the scope of a practical test.

UBA also participated in various approval proceedings for projects with possible transboundary environmental impacts, including, for example, for the Temelin nuclear power station (Czech Republic), River Elbe dams, as well as for various gas pipelines in the Baltic Sea. *(I 2.4)*

Environmental assessment of plans and programmes

On 27 June 2002, the *EU Directive on the assessment of the effects of certain plans and programmes on the environment (Directive 2001/42/EC)*. This obliges the member states to examine many plans and programmes during the start-up phase in order to assess their implications for the environment, for

example, regional planning programmes, urban land use plans, water management plans and waste management plans. Even while this Directive was being prepared, UBA commissioned a research project on this issue in 1999 which was awarded to the planning group Ökologie und Umwelt, Hannover, and Bremen's university. This project deals with the implementation of European legal requirements in the field of water and waste management planning. The final report (not yet published) develops proposals for legislation concerning the subject and provides an overview of current planning practice as well as the procedure to be adopted when performing such assessments. In order to implement the Directive, further research projects are to be commissioned in 2002. *(I 2.4)*

Protection of the Antarctic region

Approval procedure: The *environmental protection protocol on the Antarctic Treaty* (1991) placed the area south of the 60° south latitude line under special protection. The Antarctic region was declared to be a nature reserve dedicated to peace and science. The German *Environmental Protection Regulatory Statute of* 1994 that incorporates international requirements into national legislation assigned various tasks to UBA. The Agency is responsible, for example, for approving activities in the Antarctic region, for the protection of flora and fauna, and – in co-operation with the operators of research stations and ships – for matters of waste management (refer to the 2000 Annual Report).

In 2001, UBA received a total of 34 registrations and applications for approval of activities in the Antarctic region; 30 of these were related to research projects (including logistics) and four to tourism activities. In the case of tourism, the applications were primarily collective applications that covered several trips by large passenger ships.

The Agency granted its approval in most cases, however, in some cases subject to certain environmentally relevant restriction and conditions. Five of the projects were categorized as having "at least minor or temporary environmental impacts", so that they had to undergo an environmental relevancy assessment. This involved either the impacts of tourism activities on the Antarctic eco-system or the effect of acoustic equipment on whales and other sea mammals.

Statutory instruments: In 2001, the Agency was also involved in the development of numerous statutory instruments that are to supplement the Regulatory Statute to the Protocol on Environmental Protection to the Antarctic Treaty. Particular reference must be made here to the *Cost ordinance for official acts according to the Environmental Protection Regulatory Statute*. This regulatory instrument was adopted in April 2001.

Directory of locations of earlier activities: The Protocol on Environmental Protection obliges the parties to the protocol to develop directories of those locations in the Antarctic region where earlier activities have taken place. UBA has commissioned the Heidelberg-based company Geomer to prepare such a directory. This will be in the form of a comprehensive database that features both scientific, logistics and tourism activities. *(I 2.4)*

Department I 3:

Transport, noise

Public local passenger transport

Public local passenger transport is an essential pillar of our transport system. It has not been possible in recent years to expand this to the extent necessary. It is not just its social, urban-development and safety-related properties which suggest that public local passenger transport is the means of transport for the future. Also with a view to environmental protection, progressive public local passenger transport that is based on state-of-the-art environmental standards is superior to car transport.

In 2001, three projects were completed on the subject of public local passenger transport. The results of the first two projects were published in the TEXTE series. In a third project, two brochures drew attention to the importance of high environmental quality standards in public local passenger transport.

"Umweltauswirkungen der Regionalisierung des ÖPNV" [Environmental impacts of regionalising public local passenger transport] and "Umweltpolitische Handlungsempfehlungen zur Finanzierung des ÖPNV" [Environmental policy recommendations for activities to finance public local passenger transport] will be published in summer 2002 in the TEXTE se-

ries and will be available from Werbung + Vertrieb (see box on page 90). "Umweltstandards im ÖPNV – Ein Leitfaden" [Environmental standards in public local passenger transport – A guideline] and "Bus und Bahn im Umweltvergleich – Der ÖPNV im Wettbewerb" [An environmental comparison of bus and rail – Public local passenger transport in competition] are available from Verkehrsclub Deutschland (VCD), Eifelstraße 2, 53199 Bonn, Germany, telephone +40 228/9 85 85-0, telefax: 0228/9 85 85-10) against payment of a fee. (I 3.1)

Cycling and environmental protection

Apart from walking, cycling is the most environmentally compatible means of transport. The share of bicycle transport on all German roads currently averages 12 %. Compare this to the Netherlands where this is 27 %.

As some calculations show, the successful promotion of bicycle transport promises significant rewards for the environment. If 30 % of all short trips up to 6 km by car were to be taken on a bicycle, this would mean a reduction of up to 7.5 million tonnes (t) of harmful carbon dioxide. Bicycle transport can hence contribute significantly towards achieving the objectives of the Federal government's Climate Protection Programme that demands a reduction of CO_2 emissions by transport of between 15 and 20 million tonnes by the year 2005.

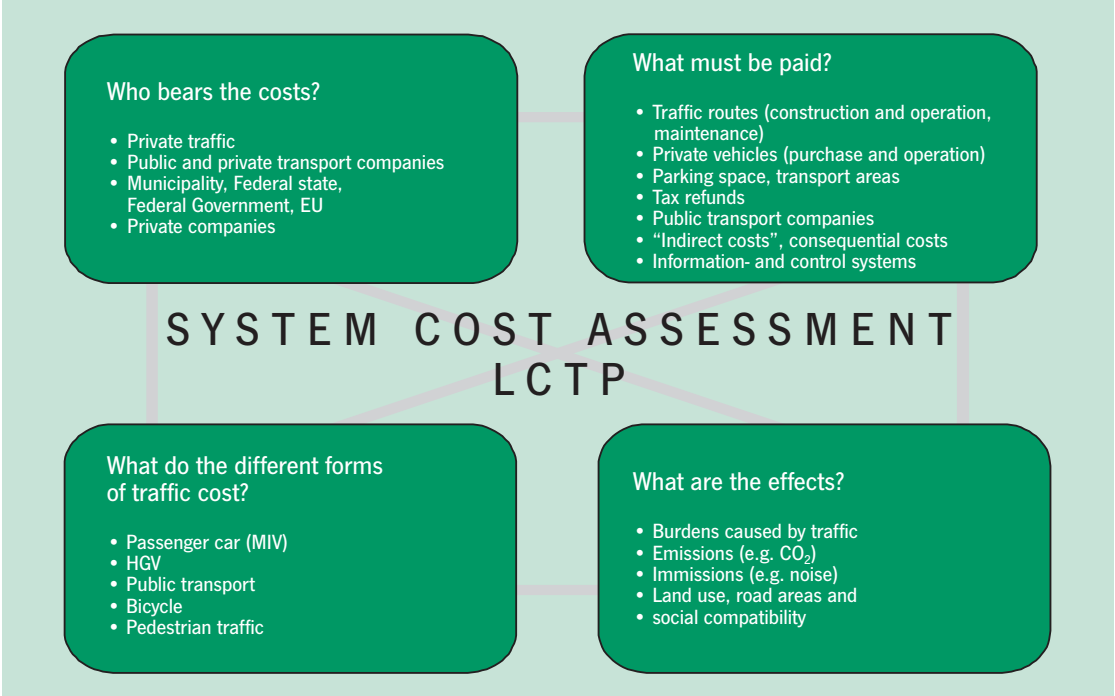
In order to make use of this potential for climate protection in Germany, bicycle transport is to be given strong support over the next ten years with a comprehensive concept for action, the National Bicycle Transport Plan. In 2001, UBA was closely involved in the work on this plan which is being issued under the leadership of the Federal Ministry for Transport (BMVBW).

Information on the Bicycle Transport plan is available on the Internet at: www.bmvbw.de. (I 3.1)

Environmental relief and reducing costs in transport

With a procedure that has been developed on behalf of UBA, municipalities can acquire an overview of their entire transport expenditure and can now assess planning projects more precisely with a view to their investment and follow-up costs as well as in terms of their implications for transport and the environment. Least Cost Transportation Planning (LCTP) was tested in the cities of Göttingen, Görlitz, Hannover and Heidelberg (Figure 18).

Figure 18: Environmental relief and reducing costs in transport



The report will be published in the TEXTE series and available from Werbung + Vertrieb (see box on page 90). *(I 3.1)*

Evaluating Federal waterway planning

Basically, freight transport on inland waterways is preferable to road freight transport from the point of view of environmental protection. However, using and expanding river systems as inland waterways means intervening in highly dynamic, natural flowing-water/meadowland systems. By expanding rivers as Federal waterways, special requirements must be placed on environmental evaluation within the scope of Federal transport network planning in order to avoid incorrect evaluations with serious consequences. In order to meet with these requirements, UBA has commissioned a research consortium under the leadership of the planning group Ökologie und Umwelt, Hannover, to carry out a research project.

The result is a practically applicable set of evaluation tools for waterway projects by the Federal government. The ecological criteria for evaluating the impacts of development measures on waterways were drafted on the basis of ecological impact analyses. The research project also deals with the environmental aspect of noise in conjunction with inland navigation. Furthermore, potential for optimising inland navigation was identified that would be suitable for limiting the demand to expand rivers. *(I 3.1)*

The study "Umweltorientierte Bewertung von Bundeswasserstraßenplanungen" [Environmental evaluation of Federal waterway planning] (TEXTE 02/02) is available from Werbung + Vertrieb (see box on page 90).

Environmentally orientated heavy-load tax

In a research project on behalf of UBA, work focused on examining the impacts of the heavy-load tax for HGVs weighing more than 12 tonnes, the so-called motorway toll which is to come into effect starting 2003. This heavy-load tax, for example, should not remain restricted to motorways, so that a shift in traffic from motorways to secondary roads can be avoided. This, however, would require a revision of the EU's Eurovignette Directive. Furthermore, the heavy-load tax can accelerate adherence to demanding emission classes if it is differentiated according to the specific emissions of HGVs. The Federal Ministry for Transport (BMVBW) will issue an ordinance here. In order to achieve a significant shift in freight transport from road to rail transport, UBA demands that rail freight transport offers be improved together with the introduction of the heavy-duty tax.

The study "Anforderungen an eine umweltorientierte Schwerverkehrsabgabe für den Straßengüterverkehr" [Requirements for an environmentally orientated heavy-load tax for road freight transport] (TEXTE 57/01) as well as the legal opinion "Umweltorientierte Schwerverkehrsabgaben aus der Sicht des Verfassungs- und Europarechts" [Environmentally orientated heavy-load tax from the point of view of constitutional and European law] (TEXTE 58/01) are available from Werbung + Vertrieb (see box on page 90). *(I 3.1)*

Regional economic cycles

Regional economic cycles are marked by the geographical nearness of products and consumption. This means that long-distance freight transport and the related burdens on the environment can be avoided. In a research project, the key parts of which were completed in 2001, the Ifo-Institut für Wirtschaftsforschung, Munich, examined the alleviation of environmental and transport burdens that result from regional economic cycles. Within the scope of this project, the Ifo-Institut analysed the legal regulations and policies in terms of the influence on regional economic cycles – from global trading policy to the EU's regional and structure policy right down to municipal business promotion. Based on the results of these analyses and supplemented by two regional case studies (Pforzheim and Hagen), the factors influencing regional economic cycles are determined and recommendations are developed to boost these factors. *(I 3.1)*

Environment, health and transport

UBA is a member of a joint work group of the UN Economic Commission for Europe (UN-ECE) and the Word Health Organization (WHO). The "UNE-ECE/WHO Joint Expert Group Transport, Environment and Health" is to work out proposals as to how aspects of environment and health can be integrated more into transport policy. A common approach by all countries in the field is vital, particularly in view of the

countries outside the EU and the countries associated through the accession process because they foster improvements in this field. *(I 3.1)*

Development of emission legislation

The EU Directives with the EURO 3 and EURO 4 emission limits for cars as well as EURO 3, 4 and 5 for commercial vehicle engines *(Directive 98/69/EC and 1999/96/EC)* were adopted in 1998 and 1999. In the work groups of the EU and the UN Economic Commission for Europe (UN-ECE) and with the involvement of experts from UBA – the following were some of the topics that were handled in 2001 for the further development of emission legislation:

- New measuring methods for limiting particle emissions from diesel engines with improved validity and efficiency
- Introduction of lasting durability requirements for reducing emissions from heavy commercial vehicles, field monitoring
- New methods for calculating pollutant emissions and fuel consumption of hybrid vehicles
- New methods for calculating pollutant emissions and fuel consumption of vehicles with periodically regenerating exhaust treatment systems
- Introduction of emission limits for powerboats and boat engines

Further details of the status of this work which is largely still in process are available from UBA's Unit I 3.2 "Schadstoffminderung und Energieeinsparung im Verkehr" [Emission reduction and energy savings in transport] (address on page 90). *(I 3.2)*

Introduction of sulphur-free fuels

With *Directive 98/70/EC,* the environment-specific requirements for petrol and diesel fuels for road traffic were determined in two stages (starting in 2000 and 2005) (refer to the 2000 Annual Report). A key parameter here is sulphur content, because the lower the sulphur content, the higher the durability and efficiency of exhaust treatment systems for petrol and diesel engine vehicles. The maximum sulphur content permitted is to be reduced in two stages to 50 ppm (parts per million, milligrams of sulphur per kilogramme of fuel).

The car industry has formulated its own fuel requirements in the "World-wide Fuel Charta" which stipulates a sulphur content of less than 10 ppm in petrol and diesel fuels for regions with extremely strict emission regulations (refer to the 1999 Annual Report). According to manufacturers, this is necessary in order to introduce methods for reducing nitrogen-oxide in diesel cars and commercial vehicles as well as in lean petrol engines: it is claimed that with these methods, a reduction in consumption and hence in CO_2 of between 15 and 20 % is possible.

Since 1 November 2001 in Germany, tax incentives have been in place for "low-sulphur" petrol and diesel fuel with less than 50 ppm and, starting 1 January 2003, for "sulphur-free" petrol and diesel fuel with less than 10 ppm, whilst a tax of 1.5 pfennig/litre is to be imposed on other fuels with higher sulphur levels. The result of this tax-based differentiation is that since 1 November 2001 only "low-sulphur" petrol has been on offer in Germany.

Prompted by Germany (refer to the 2001 Annual Report), the EU Commission looked into the introduction of sulphur-free fuels and in May 2001 tabled a proposal for the updating of Directive *98/70/EC* with which sulphur-free fuels are to be introduced step-by-step throughout the EU starting in a third step in 2007. This proposal was in principle accepted during the first reading before the European Parliament in September 2001, however, shorter introduction times, for example, were proposed. It can be assumed that agreement will be reached in 2002 and hence sulphur-free fuels will soon be available not just in Germany but throughout the entire EU. *(I 3.2)*

Particle filter for cars successfully tested

A comparison between petrol and diesel engines shows that the carcinogenic potential of diesel engine emissions in today's car models – as long as they are not fitted with particle-filter systems – is at least 10 times higher than in the case of emissions from comparable petrol engines. Particle emissions were the reason for this poor result for diesel fuels.

This problem can be solved by exhaust after-treatment using particle filters. The filter itself is about the same size as an exhaust silencer. Ceramic, metal-sinter and fibre filters among others have been tried and tested in different versions; elimination rates of far higher than 90 % of the particle mass are achieved. With particle filters, the gap between diesel and petrol

engines narrows in terms of the health-related impacts of their emissions to such an extent that a significant difference no longer exists.

In 2000, a French company was one of the first car manufactures to launch a diesel car with a particle filter as a standard feature, hence meeting with the long-standing demand of environmental protection. Some car manufacturers still question the long-term suitability of particle filters and are looking for a solution directly in the engine.

On the whole, with the particle filter fitted to the exhaust, particle concentrations almost even reach those of the ambient air as was successfully demonstrated over 80,000 km by the Peugeot 607 HDI model in a durability test carried out by Allgemeiner Deutscher Automobil-Club (ADAC) in co-operation with UBA (Figure 19). The particle filter did not lead to any significant increase in consumption. The filter was still just as effective at the end of the durability test and hence could be used for a further 80,000 km.

The particle filter reduced the particle count by a factor of 10,000 and hence set the standards for particle reduction today. Engine-based measures alone will not be able to achieve such a reduction in the foreseeable future. Following integration into the design of a new car model and fitted as a standard feature, as in the case of Peugeot, the cost of the particle filter is hardly noticeable.

A diesel car with a particle filter still has one disadvantage compared to a petrol car when you compare emissions from today's new vehicles: It emits eight to ten times more nitrogen oxide which, among other things, contributes towards the formation of harmful summer smog. The Federal government and the EU are working on a further limit level, i.e. EURO 5 in which diesel cars will be brought in line with petrol cars in this respect, too. *(I 3.2)*

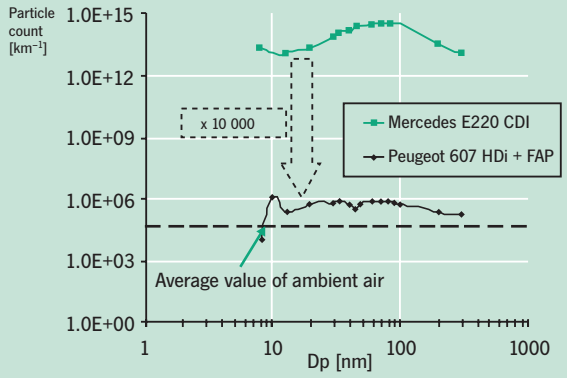
Exemplary use of natural gas vehicles

The model project "Exemplary use of natural gas vehicles" was officially concluded on 13 August 2001 by Federal Minister for the Environment, Jürgen Trittin, at a closing event held in Hannover.

Within the scope of this project, the BMU and UBA supported the acquisition or conversion of 3,300 natural gas vehicles (buses, delivery vehicles, cars) in Hannover, Augsburg, Bad Harzburg, the district of Wernigerode and on the island of Usedom with a total of DM 42 million (just under 21.5 million euro). The different conditions that prevail in big cities, rural districts, as well as in spas and bathing resorts were considered here.

Thanks to the use of natural gas vehicles, a total of 100 tonnes of nitrogen oxide and around 11 tonnes of diesel soot were avoided in the model regions. The filling station infrastructure was expanded during the course of the project, so that around 210 natural-gas filling stations were available in Germany by the end of 2001. *(I 3.2)*

Figure 19: Effect of the particle filter on particle count and particle spectrum (ADAC 8/2001) (Mercedes without a particle filter – Peugeot with an FAP particle filter)



Measurement using SMPS at a constant speed of 80 kph (Mercedes 6th gear Peugeot 5th gear)

International environmental protection in air traffic

The environmental unit of the International Civil Aviation Organization (ICAO), i.e. the Committee on Aviation Environmental Protection (CAEP), is responsible for defining international guidelines and hence the limits for emissions from aircraft engines. For many years now, UBA has been working in the CAEP's three work groups which deal with measures for reducing emissions, as well as the group dealing with market-economy instruments in air traffic. The findings of studies carried out on this subject on behalf of UBA have been contributing to the discussion on the shaping of route-based emission duties and emission trading in air traffic. *(I 3.2)*

Revision of the Act on Aircraft Noise

Germany's Federal government intends to revise the Act on Aircraft Noise of 30 March 1971 in order to achieve a significant improvement in noise protection at civil and military airports. The objectives of this revision are described in the BMU detail paper that is available on the Internet at: www.bmu.de.

Based on this detail paper and other measures for reducing aircraft noise, the BMU, in co-operation with UBA, has prepared a draft bill of the revised Act on Aircraft Noise. UBA has carried out an extensive examination of the overall costs which will be incurred by airport operators as a result of this draft bill. According to this examination, the costs for civil airports are estimated at 530 million euro. For military airbases and air/ground firing ranges, these costs are estimated at around 720 million euro. The costs for the individual airports/airbases are incurred in the first few years after the noise protection range is defined on the basis of the revised Act on Aircraft Noise.

The costs for civil airport operators can be passed on according to the polluter-pays principle via the airport fee to aircraft owners or airlines. In this context, UBA has roughly estimated the required increase in landing fees. The airlines could pass on the increase in landing fees via flight prices to their customers. The estimated increase in flight prices differs depending on the volume of traffic at the individual airports. In the majority of cases, this totals up to 3 euro per flight ticket – over a 10-year period. The costs were spread over this period of time, because regular examination of the Act on Aircraft Noise is carried out every ten years.

The model calculations carried out by UBA clearly show that the costs that result from the draft bill for sufficient structural sound insulation as well as for compensation for the adverse effects on the outdoor living area can be financed by a slight increase in flight prices. *(I 3.3)*

Noise and emission reductions in rail traffic

The structures in local public passenger transport are currently in a process of change. The EU Commission is accelerating the rate at with the local public passenger transport market is being liberalized and is giving preference to pan-European calls for tenders for traffic services.

There is a danger here that environmental and service standards in local public passenger transport could suffer in the resultant bidding competition.

The transport association Verkehrsverbund Berlin-Brandenburg (VBB), in co-operation with UBA, has developed demanding environmental standards which will be adopted for the first time nationwide in a call for tenders for rail-bound transport services. These standards primarily stipulate adherence to stricter standards for noise and exhaust emissions from railcars. These standards mean that new traction vehicles will be around 8 dB(A) quieter than the train engines currently used and that significantly less amounts of soot and nitrogen oxides will be pumped into the environment. *(I 3.3)*

Adherence to vehicle noise regulations

In an ongoing research project, UBA has commissioned TÜV Rheinland, Cologne/Berlin, to examine whether after many years in use vehicles still comply with the specified limits for noise or the type-test values stated in the vehicle's registration papers. This study is now almost completed. The results acquired up to now conform that this kind of field test does make sense: In the case of one delivery vehicle type, two of the three vehicles examined violated the limit for driving noise – a defective engine fan coupling was found to be cause for this.

In the cars examined up to now, the type-test values were exceeded by up to 4 decibels [dB(A)]. *(I 3.3)*

Division II: Environment and Health: Water, Soil and Air Hygiene, Ecology

Department II 1:

Ecology

Climate protection needs intact ecosystems

It is a generally accepted fact that climate changes endanger plants, animals and their habitats by affecting the variety of species living in ecosystems and the occurrence of animals and plants. However, a much-neglected fact is also that the biosphere itself is an important part of the entire climate system. The biosphere, for example, is capable of storing the carbon from the greenhouse gas carbon dioxide (CO_2), it controls the water circulation and hence the formation of clouds, it stores or reflects sub radiation and thereby exerts an essential influence on our climate. The destruction of ecosystems or the impairment of their functioning can thus lead to climate changes. Tropical forests, for example, release large amounts of carbon when they are cut down, burnt and converted to pastures. Protection of ecosystems must hence be one of the aims of climate protection.

Climate system and biosphere mutually benefit from measures designed to protect the climate and biodiversity, for example, with regard to the protection of forests which is important for both aims. However, conflicts can also arise when non-native species of trees are planted. A report prepared by the Berlin-based Öko-Institut shows ways in which these synergies can be put to good use, how conflicts can be resolved and how interaction between the two UN conventions adopted in Rio de Janeiro in 1992, i.e. the *Rio Framework Convention on Climate Change* and the *Convention on Biological Diversity*, can be improved.

In continuation of this work, the Federal Environmental Agency (UBA) and the Federal Nature Conservation Agency (BfN) organized a European workshop on these issues in December 2001 on the island of Vilm. Experts for climate and biodiversity discussed which conceivable solutions would benefit both climate protection and the protection of biological diversity. They agreed to several key conclusions to be integrated into the international work under both conventions.

The report titled "Requirements of climate protection with regard to the quality of ecosystems: Use of synergies between the Framework Convention of Climate Change and the Convention on Biological Diversity" (UBA-Reihe "Climate Change" 03/01 and 04/01) is available in German or English from UBA's Central Services Unit (address: see left). The key conclusions are available on the Internet at: www.umweltbundesamt.de, key word "biological diversity" and at: www.biodiv-chm.der.

(II 1.1, II 2.7)

Comprehensive reports and background information are available on many of the topics. Literature from the Federal Environmental Agency (UBA) can be purchased from Werbung und Vertrieb, Ahornstraße 1–2, 10787 Berlin, telephone +49 30/2 11 60 61, telefax +49 30 2 18 13 79. Material is also available free of charge from UBA's Central Services Unit, Bismarckplatz 1, 14193 Berlin, Germany, telephone +49 30/89 03-2400, 2422, -2304, telefax +49 30/89 03-2912. A free list of all UBA publications is also available from this unit. Information concerning the entire range of information available, as well as summaries of selected publications, are also available on the Internet at: www.umweltbundesamt.de, under "Publications"

Environmental targets in regional planning

Some years ago, UBA tried to improve the integration of basic ecological information and environmental targets into a regional development programme within the scope of a pilot project in the Wesermarsch marshlands (refer to TEXTE 27/98). Despite a very good foundation, the result was rather discouraging in the regional development programme in its ultimately adopted form. This was not due to the technical side, but rather due to organizational issues, processes and the rules for setting up regional development programmes. In the planning region of the Mecklenburg lake district, the new instrument of the regional conference was therefore adopted with a co-operative, action and project-orientated **BOTTOM-UP APPROACH** parallel to the preparation of the regional development programme according to the usual **TOP-DOWN APPROACH**.

On behalf of UBA, the regional planning committee for the Mecklenburg lake district drafted a report on the basis of parallel research in co-operation with the Neubrandenburg technical college which examined the thesis according to which bottom-up or combined regional planning approaches are better suited for the implementation of environmental targets. The project clearly confirmed this thesis. The authors developed recommendations for the further optimisation of practical planning work and summarised the results in a management guideline for co-operative regional development orientated towards practical application.

The report titled "Auswertung neuer Vorgehensweisen für die regionale Umsetzung ökologischer Ziele am Beispiel der Mecklenburgischen Seenplatte" [Evaluation of new approaches for the regional implementation of ecological targets based on the example of the Mecklenburg lake district" and the pertinent management guideline will be published as a UBA publication. (II 1.1)

The top-down approach: *The higher-level planning authority lays down and adopts regional development targets. These targets must be accepted by the lower-level areas, including the population groups that are directly affected.*

The bottom-up approach: *Those who are affected by regional problems themselves develop the solutions and development targets. The targets are integrated into higher-level plans and programmes.*

Ecosystem research in the mud flats

In conclusion of the integrated interdisciplinary project on ecosystem research that was conducted from 1989 to 1999 in the mud flats of Schleswig-Holstein and Lower Saxony, the results and findings were compiled in an overall synthesis. Seven researchers at the Wilhelmshaven-based Terramare research centre, at UBA and at the national park administration of the Lower Saxony mud flats evaluated the material from more than ten years of ecosystem research.

Specific results presented by the authors include papers on the system understanding, on structures and processes of natural spaces, sediment dynamics, exchange of substances and ecology of species. Eutrophication (excessive accumulation of nutrients) and its consequences were studied as exogenous factors. Fisheries and tourism were studied as factors within the mud flats. Besides recommendations for further development, criteria for an ecosystem-orientated environmental view in the mud flats were developed. In terms of these aspects, a need for improvement was found with regard to the monitoring parameters.

Several reports were published on ecosystem research in the mud flats. They are available, against payment of a fee, from Forschungszentrum Terramare, Schleußenstr. 1, 26382 Wilhelmshaven, telephone: +49 4421/9 44-0, fax: +49 4421/944-199. (II 1.1)

Environmental monitoring in the Rhön mountains

Together with the Federal state of Bavaria and in co-operation with the Federal states of Thuringia and Hesse, UBA promoted a pilot project on **ECOSYSTEM-RELATED ENVIRONMENTAL MONITORING** in the Rhön biosphere reserve from 1997 to 2001. Important results concerning the methodological approach towards the development of the concept were a central data record for the monitoring programme, as well as an evaluation concept. This was the basis for an exemplary environment report for the Rhön biosphere reserve.

Cause-and-effect hypotheses were developed as part of the evaluation concept. These hypotheses are divided into ten complexes that address major environmental problems, such as changes in biological diversity and their consequences.

The results of the Rhön project were presented for the first time to a larger audience and discussed during a closing event in the Rhön biosphere reserve in November 2001.

Ecosystem-orientated environmental monitoring: *This approach is designed to enable the early identification of changes in processes and functions in the ecosystem (early warning function). This provides the opportunity to launch counter-measures even before serious environmental problems become apparent. Furthermore, the value and efficiency of existing environmental monitoring programmes and measuring networks can be enhanced by the improved co-ordination of ongoing monitoring activities and integrated data evaluation.*

The final report titled "Modellhafte Umsetzung und Konkretisierung der Konzeption für eine ökosystemare Umweltbeobachtung am Beispiel des länderübergreifenden Biosphärenreservates Rhön" [Model implementation and detailed preparation of the concept for ecosystem-orientated environmental monitoring based on the example of the multi-state Rhön biosphere reserve] is to be published in the TEXTE series in summer. Free copies of the information brochure "Ökosystemare Umweltbeobachtung – vom Konzept zur Umsetzung" [Ecosystem-orientated environmental monitoring – from the concept to its implementation] are available from the Central Services Unit (address on page 109.) Further information is available on the Internet at: www.umweltbundesamt.de, key word: "Ökosystemare Umweltbeobachtung" [Ecosystem-orientated environmental monitoring]. *(II 1.1)*

Working group on "effects"

In August 2001, the work grouping group on "effects" of the *UN-ECE Convention on Long-range Transboundary Air Pollution* (UN-ECE: United Nations Economic Commission for Europe) elected a UBA representative as its chairman. This is the first time that a German scientist is chairing the expert group in which government representatives from up to 40 countries are working. This working group evaluates ecological monitoring programmes in Europe and North America, analysing the tolerance limits of the environment in relation to air pollutants. The results are integrated into international conventions on the reduction of pollutant emissions into the atmosphere (air quality protocols) and thereby contribute towards improving transboundary air quality. Future work will focus on the ecological effects of heavy metals, health problems related to fine dust, and air pollution in densely populated regions.

Further information from the working group on "effects" and information concerning the Convention on Long-range Transboundary Air Pollution can be found on the Internet at: www.unece.org/env/wge.
(II 1.2)

Environmental hormones: second status seminar

As early as 1995, UBA organized the first German technical talks on chemicals in the environment which may affect the hormone system in humans or animals. It was found at that time that the occurrence of these substances in the environment can cause significant risks to humans and animals. It was suspected that these substances might have a negative impact on reproduction, behaviour and immunological defence. However, the scientific studies available at that time were very incomplete, so that it was almost impossible to assess the order of magnitude of these risks.

In order to foster research on environmental hormones, UBA, the Federal Ministry for the Environment (BMU) and the Federal Ministry of Education and Research (BMBF) launched a joint, interdisciplinary research programme with a total volume of more than six million euro. In 1996, more than 100 projects were proposed in response to the invitation to

submit proposals, with 13 proposals being selected following scientific evaluation. These projects covered the fields of environmental monitoring, development of test methods, effects on human health, as well as changes in ecosystems.

Scientific work on the projects started in 1997, and a first status seminar was held in Dresden in 1998. The final results were presented and evaluated on a status seminar in Berlin from 2 to 4 April 2001. More than 170 scientists discussed the issues of "exposure to environmental hormones, ecotoxicology and human toxicology".

Exposure: Chiefly as a result of the activities of some countries, a good picture of the environmental concentrations of hormone-active chemicals was developed. Very detailed information concerning concentrations of alkyl phenols, bisphenol A and organotin compounds in surface waters has now become available. In some cases, the measured concentrations could be correlated with defects found, particularly in fish and mussels. In contrast to this, findings on naturally and pharmaceutically used oestrogens are still contradictory even though they are very likely to account for a substantial part of the total pollution of waters with substances with a hormonal effect.

In contrast to this, the data presented on human exposure was quite limited and did not permit a final assessment of human exposure. The data so far available is almost exclusively limited to tissue concentrations of persistent (long-life) organic chlorine compounds. Studies of the environmental specimen database and by Berlin's Benjamin Franklin university hospital on human exposure to brominated flame retardants and the exposure of the placenta and umbilical-cord blood to bisphenol A clearly showed that much larger spectrum of chemicals must be analysed in order to obtain a fairly reliable picture of overall human exposure to environmental hormones.

Ecotoxicology: When the research programme on environmental hormones was launched in 1996, one of the most important questions in the field of ecotoxicology was how far the exposure of ecosystems to environmental hormones reaches. After five years, the status seminar showed that environmental hormones can be found in surface waters almost everywhere in Germany and that concentrations are high enough to trigger an effect on organisms. Effects can be observed today both in inland waters and in coastal waters alike. Negative changes in the form of feminisation and reproduction disorders are found not just in fish, but also in other animal species which previously met with less attention, such as molluscs and other invertebrates, as well as sea mammals. It became obvious that these effects occur not just in places which are subject to particularly high burdens (hot spots) due to historical pollution at contaminated sites, but that negative effects of environmental hormones are also a very wide-spread phenomenon. The research projects presented today enable a much more detailed assessment of the situation in Germany than was possible just a few years ago.

Human toxicology: Some projects studied the effect of very small doses of environmental hormones. Bisphenol A, an important industrial chemical, and daidzein, a vegetable ingredient with a structure and effect similar to those of oestrogen, were used as the model substances in almost all the research projects. Besides toxicokinetic studies designed to explore the fate of the test substances in the organism, there was one particular question that met with considerable interest: How do different environmental hormones interact when the organism is exposed to them at the same time? The status seminar showed how difficult it is to interpret the results of this human-related research. This was in part due to the concept itself and in part due to unexpected problems which arose during the experiments. The researchers did, however, agree that the effects add up in most cases when examined in the test tube. This showed that the evaluation of a single substance only permits only limited statements on the effects of endocrine substances on an organism which is in fact exposed to a large number of environmental substances.

Conclusion: It was not surprising that every question that was successfully answered by the research programme now concluded triggered another two new questions. From a scientific point of view, this may be unsatisfactory, but the agencies and ministries in charge of monitoring and regulating these substances considered the research programme to be a huge success. The results presented here are an important basis for the discussion on risk assessment and risk reduction at a national, European and international level. Many of the results presented

here were integrated into UBA's strategy for environmental hormones.

The research programme that was presented at the status seminar was the result of broad-based co-operation which included not just two ministries and their scientific agencies, but also scientists from different countries, as well as representatives from universities and business, environmental organizations and consumer protection associations. This co-operation will be continued in future in order to promote ongoing research in this field.

The complete report of the status seminar is available on the Internet at: www.status-umwelthormone.de.
(II 1.3/II 2.2)

Air mapping programme

Within the scope of the mapping programme of the UN-ECE Convention on Long-range Transboundary Air Pollution which is managed by Germany and co-ordinated by UBA, several international workshops were organized in 2001, including, for example, the following:

- Three meetings on the application of dynamic models of cause-and-effect research in south east Europe in Zagreb (Croatia), Bled (Slovenia) and Karcag (Hungary)
- One sub-regional workshop in Chisinau (Moldavia) on the mapping of critical loads (refer to chapter 1) and violations of critical loads in east European countries
- One trilateral meeting of Poland, the Czech Republic and Germany in Neuschönau with the aim to co-ordinate methods for critical-load mapping.

(II 1.2)

Methods and instruments for trans-media environmental monitoring

As a result of a research project, the Institute for Environmental Sciences at Vechta University has developed a set of methodological tools for the documentation, editing and integration of environmental monitoring programmes by the Federal government and the Federal-state governments on behalf of UBA. This work is based on the permanent programmes which are pursued at Federal and Federal-state level. With previous research projects, UBA had started to compile an overview of existing programmes.

One aim of environmental monitoring is to offer the integration of these measuring networks – depending on technical requirements and political needs – into a trans-media view and to offer this expertise to the Federal states. This requires methods and models as vital tools using geostatistical methods in order to enable the geographical networking of environmental monitoring data.

The Geographical Information System Environmental Monitoring (GISUB) developed within the scope of the research project links the meta data for and from the environmental monitoring programmes to the underlying measuring-network geometries. This means that previously isolated information can be integrated and used to describe, explain and evaluate the condition of the environment in its entirety.

The study titled "Konkretisierung des Umweltbeobachtungsprogramms im Rahmen eines Stufenkonzeptes der Umweltbeobachtung des Bundes und der Länder" [Concrete definition of the environmental monitoring programme within the scope of a gradual environmental monitoring concept by the Federal government and the Federal-state governments] is available on loan under number UBA-FB 000 226 from UBA's library (address on page 2). *(II 1.4)*

Standardized sampling

A procedure for routine soil sampling was defined for the Environmental Specimen Bank of the Federal government. This procedure was developed by the Fraunhofer Institute for Molecular Biology and Ecotoxicology, Schmallenberg. Soil samples will be taken for the first time in 2002 in nine different areas covered by the Environmental Specimen Bank.

All the 33 guidelines of the Environmental Specimen Bank are currently being updated. For further information, please refer to: www.umweltprobenbank.de.
(II 1.4)

Geographical classification of Germany

One basis for the analysis and evaluation of monitoring networks is their classification in terms of landscape-ecological geographical classes (natural spaces). Using the CART approach (**C**lassification

and **R**egression **T**rees), Germany is divided into space classes on the basis of the landscape-ecological parameters of climate, relief, soil which are characterized by similar manifestations of the underlying features (figure 20).

The results of the research project enable operators of monitoring programmes to optimize their systems.

Further information is available on the Internet at www.iuw.uni-vechta.de/personal/oekologie/schroeder/ub_uba/start.htm. *(II 1.4)*

Dioxins in the environment

A wealth of information is available on sources, generation mechanisms and propagation of polychlorinated dibenzodioxins and dibenzofurans (PCDD, PCDF) in the environment. This information is the result of numerous measuring and observation programmes as well as research projects. Notwithstanding this, it has not yet been possible to fully explain the total quantities of PCDD and PCDF in the environment. In order to support this effort, UBA started building the DIOXINS database of the Federal and Federal-state governments in November 1991 as a result of a resolution by the 37th Conference of the Ministers of the Environment. This database contains data from more than 100 measuring programmes for the different environmental media.

A research project which the Society for the Promotion of Environmental, Education and PR Work at Bayreuth University carried out on behalf of UBA gives an overview of the exposure situation of the environmental media of soil and air as well as organisms in Germany. The data was evaluated in co-ordination with the Federal states. PCDD/F pollutions in the air, for example, is down to around 50 % compared to the beginning of the 1990s. Taking four Federal states, figure 21 shows that the values have remained at a largely constant level since around 1994.

The DIOXINS work group of Federal and Federal-state governments evaluated further data from a dioxin reference measuring programme. This programme is co-ordinated by the North-Rhine Westphalian government and studies selected sites and environmental media.

Figure 20: Geographical classification of Germany

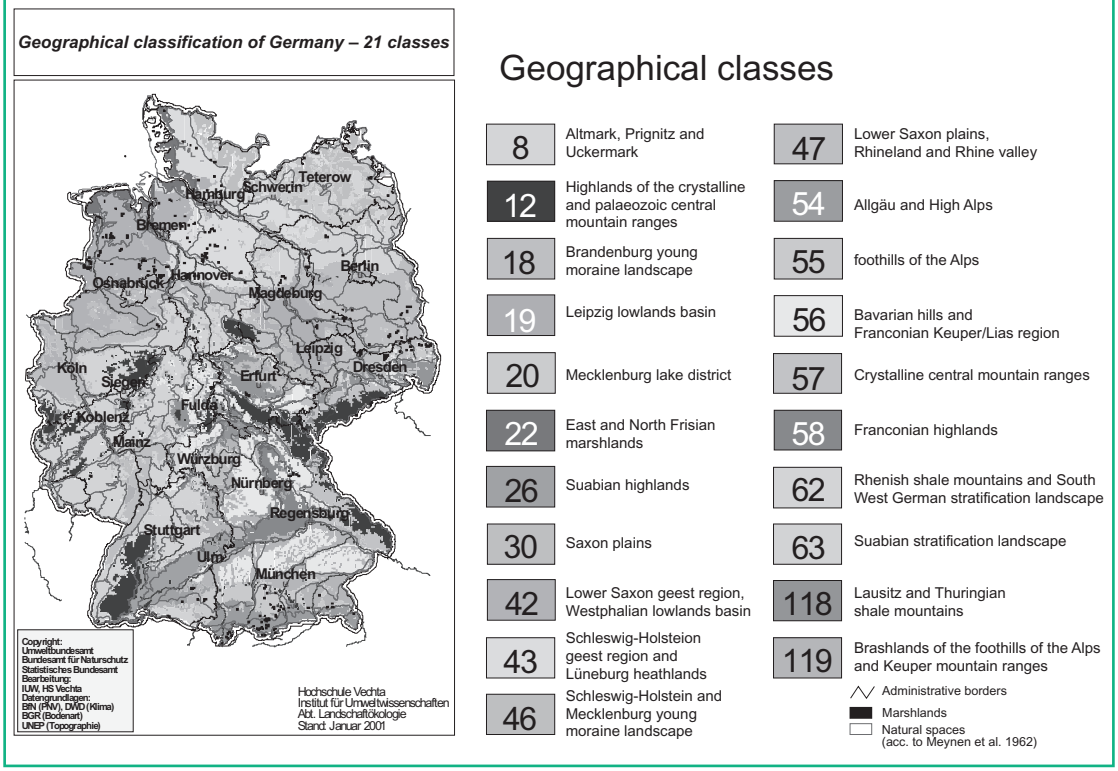
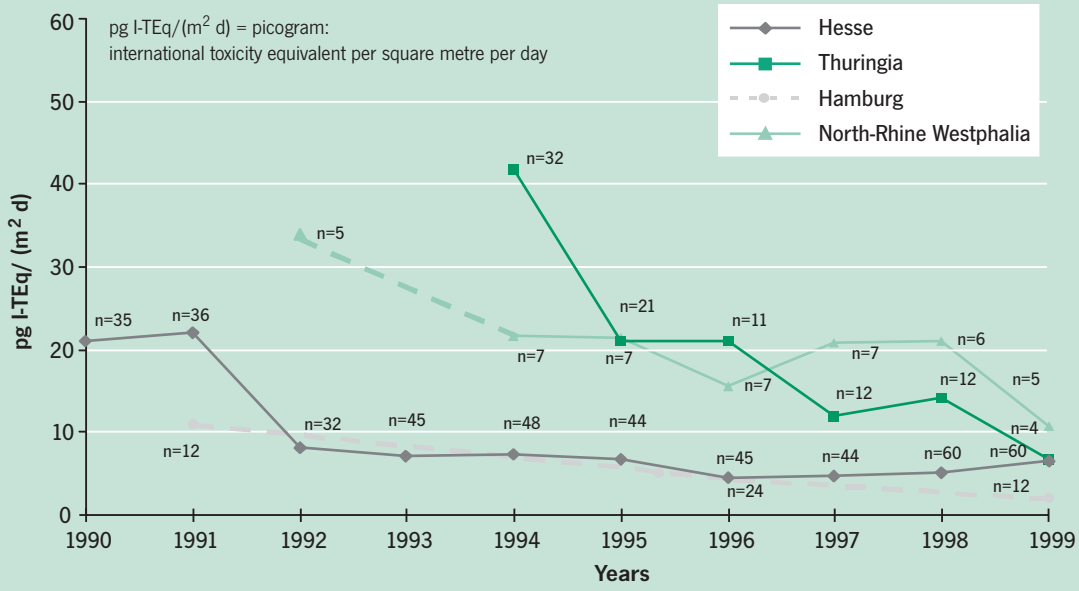


Figure 21: Annual mean values of dioxin and furan (PCDD and PCDF) deposition values in Hesse, Thuringia, Hamburg and North-Rhine Westphalia



The results of the dioxin reference measuring programme and the results of the research project (3rd and 4th reports by the DIOXINS work group of Federal and Federal-state governments) titled "Dioxine – Daten aus Deutschland" [Dioxins – data from Germany] are available from Werbung + Vertrieb (address on page 109). *(II 1.4)*

Department II 2:

Environmental hygiene

APHEIS – a source of information on air pollution and health

Since 2000, the Collaborating Centre for Air Quality Management and Air Pollution Control of the World Health Organization (WHO) hosted by UBA has been co-operating in the European APHEIS (**A**ir **P**ollution and **H**ealth: A **E**uropean **I**nformation **S**ystem) project. This project is sponsored by the Directorate General for Health and Consumer Protection within the scope of the "Environment-related diseases" programme and aims at setting up a network which will be open to both decision-makers and experts in the environment and health sectors, as well as to the interested public. The aims of the APHEIS include, for example:

- To create an active network for information on health and environment which facilitates the flow of information between environment and health experts and fosters the development of technical expertise at a European level
- To optimize processes for measuring air pollutants in air monitoring networks, so that these networks will meet with the requirements for monitoring public health
- To create a European epidemiological monitoring system which will include a comprehensive database on "Air pollutions and public health"
- To provide regular standardized reports on the influence of air pollution on public health in order to meet with the information demands of the three user groups, i.e. politicians, scientists and citizens

The project is co-ordinated by the French Institute for Public Health (Institut National de Veille Sanitaire, Saint Maurice) together with the Communal Institute for Public Health in Barcelona (Institut Municipal de Salut Publica) and the Bonn office of the WHO European Centre for Environment and Health.

The WHO Centre for Air Hygiene at UBA was the managing partner in a project that focused on developing guidelines for the implementation of the epidemiological monitoring system in 2000/2001.

These guidelines are currently being tested in 26 cities in 12 European countries. German cities are currently not involved. There are, however, plans to pursue the epidemiological monitoring system on an ongoing basis and to extend it to further European cities in order to create the preconditions for long-term monitoring and hence the identification of possible long-term effects through an ongoing data gathering and data compilation programme. German cities will also be given the opportunity to take part when the programme continues.

Further information concerning the APHEIS project is available on the Internet at: www.apheis.org.
(II 2.1/WHO Luft)

Classification of carcinogenic substances for the revision of Technical Instructions on Air Quality Control

The *Technical Instructions on Air Quality Control (TA Luft)* from 1986 are an implementation regulation for the *Federal Immission Control Act (BImSchG)* and contain a classification of carcinogenic substances in three action-related categories with different emission limits. The classification in terms of action classes is also planned for the revised Technical Instructions on Air Quality Control which are currently in work.

During this revision work, it had to be decided whether and which new carcinogenic substances were to be added to the Technical Instructions on Air Quality Control. Furthermore, the Freiburg-based Research and Advisory Institute for Hazardous Substances examined the potency of the substances in a research project.

21 carcinogenic substances were divided into three action classes depending on their carcinogenic potency, with different emission limits defined for each of these categories.

The study titled "Klassierung krebserzeugender Stoffe zur Begrenzung der Massenkonzentrationen im Abgas nach Nr. 5.2.7.1.1 der TA Luft-Novelle (Entwurf)" [Classification of carcinogenic substances in order to restrict mass concentrations in exhaust gas pursuant to No. 5.2.7.1.1 of the (draft) revision of the Technical Instructions on Air Quality Control] (BERICHTE 03/02) was published by Erich Schmidt Verlag, Berlin, and is available at bookstores (ISBN 3-503-06633-0). *(II 2.1)*

PCBs in indoor areas

Human exposure to polychlorinated biphenyls (PCBs) in Germany declined strongly in recent years. However, intake of PCBs in food and – to a lesser extent – in air still continues. Sealing and filler compounds containing PCBs are today probably the main source of elevated PCB concentrations in room air. Reports of PCB-contaminated schools have triggered a renewed debate on PCBs in recent months.

In 1998, the WHO defined a tolerable daily intake (TDI) value which covered both dioxins and furans as well as twelve PCBs similar to dioxin. The fact that this evaluation concept does not include the vast group of PCBs not similar to dioxin leads to uncertainty when it comes to assessing the risk this group of substances poses. This was also the reason why previous recommendations for PCB-contaminated schools came under scrutiny. An ad-hoc work group at UBA, consisting of representatives of the Indoor Air Hygiene Commission and the Working Group of the Federal States on Health Protection which is responsible for evaluating indoor pollutants, has started consultations.

In co-operation with external experts, the vast number of recent publications (more than 1,000) on the toxicology of PCBs was examined. Studies of the effect on nerves, immunological system, liver and thyroid gland met with particular interest. Great importance is also attached to human biomonitoring (HBM): Data that was newly gathered within the scope of the Environment Survey (refer to the 2000 Annual Report) is used to characterize the actual exposure situation. Although the data is difficult to interpret in view of the wealth of information – in particular, for the indoor situation – the consultations are expected to be concluded in 2002. By that time, UBA recommends using the so-called 1995 *PCB Directive* (Directive for the assessment and rehabilitation of PCB-contaminated construction materials and structural parts in buildings) as a basis for rehabilitation measures. *(II 2.2)*

Measurement of airborne germs in the vicinity of liquid manure storage tanks

In its own research project between 1999 and 2001, UBA studied concentrations of airborne germs (bacteria, spores) in the more immediate vicinity of liquid manure storage tanks in agriculture. Open storage tanks of this kind where liquid manure is stored until

it is spread on the land are still quite common. Intermediate storage is necessary because the spreading of liquid manure is only permitted during certain months in Germany in order to avoid overstraining the absorption capacity of soils and to prevent increased immissions, for example, of nitrates, into the groundwater.

The studies were conducted at an open liquid manure storage tank in the centre of a village in the direct vicinity of residential buildings. Higher germ concentrations were found in the wind coming from the manure tank (weather side) than on the leeward side. Germ concentration decreased by a factor of two to five with increasing distance (measurement at a distance of 80 m compared to a distance of 40 m). Increased germ exposure in the area of neighbouring residential buildings (at a distance of 100 m) was found in rare cases only. The study thus suggested that residents living near the liquid manure are not exposed to a higher health risk. As a preventive measure – and in view of the fact that temporarily elevated concentrations of germs and, in particular, of faecal bacteria cannot be fully ruled out on the leeward side – it is recommended that open storage tanks be generally covered in the vicinity of residential areas in the medium term. Another option would be to relocate storage tanks of this kind to areas away from settlement areas. This is also required under the Technical Instructions on Air Quality Control for new tanks. *(II 2.3, II 2.4)*

Softeners and flame retardants in dust

Softeners are auxiliary substances which are used to achieve flexible and elastic properties of numerous products and materials used in everyday life. Flame retardants are also auxiliary materials that give products into which they are incorporated flame-retardant properties which are partially required by law. Compounds which are the subject of a more intensive public debate in view of potentially harmful effects for health include, above all, diethylhexylphthalate (DEHP) from the group of softeners and tris(2-chlorethyl)phosphate (TCEP) from the group of flame retardants. TCEP is also used as a softener. One feature which all compounds have in common – despite sometimes very low volatility – is that they are released from the original products and materials into the environment, so that they are also found in indoor environments.

Due to their large specific surface (surface per mass), dust particles are capable of effectively taking up compounds, in particular, compounds that are not easily volatilised from the air. It is hence important to analyse airborne particles or deposited dust, i.e. "household dust". The ultimate aim of studies of this kind is to evaluate the health relevance of household dust that is inhaled or taken in orally, in particular, in the case of toddlers.

In a long-term study, UBA developed a new analytical method (liquid chromatography coupled with mass spectrometry) that enhances the range of analytical methods. This method was used in a pilot study, chiefly to analyse dust that had been collected on shallow aluminium trays. Twelve softeners and six phosphorus-organic flame retardants were found in this dust.

Among the softeners, DEHP is the most commonly found compound with a content averaging 260 milligrams per kilogramme (mg/kg) of dust collected. The maximum value was recorded for diethylphthalate at a level of 1,600 mg/kg. Due to the debate on the harmful effect of DEHP on health, manufacturers have started substituting DEHP with other softeners with a lower volatility and toxicity profile. One of these substitutes is didecyl phthalate with a median value of 78 mg/kg.

Compared to softeners, flame retardants occur in lower dust contents, with tris(2-butoxyethyl)phosphate as the main component reaching a median value of 1 mg/kg and a maximum value of 210 mg/kg. Substantially lower values were recorded for TCEP with 2.5 mg/kg and 6.8 mg/kg, respectively.

The few air concentration values determined during the pilot phase for not easily volatilised, dust-borne softeners and flame retardants were in the lower ng/m^3 range. The concentration of the widely used DEHP is the only value which is higher at a level of around 0.5 µg/m^3. Adverse effects on health are unlikely in this concentration range. However, the changing and ever-increasing variety of softeners and flame retardants in indoor spaces will require ongoing, careful monitoring.

Further information on orientation values for indoor area is to be found on the Internet at: www.umweltbundesamt.de/uba-info-daten/daten/irk.htm#4.

(II 2.3)

Accumulations of black dust in flats

In 1995/96, UBA received first reports on accumulations of black, greasy dust in flats which occurred during the cold season. The reason for this remained unknown because neither incineration processes in the flats nor external influences could be blamed. UBA initially launched a comprehensive questionnaire campaign in order to explore the dimension of the problem and details thereof in the flats concerned.

The "black flats" phenomenon shows a clear upward trend from year to year. After renovation work or when flats in newly built houses are used for the first time – in most cases, during the first cold period following renovation work – dark stains were found on walls and other surfaces. In order to explore this phenomenon, an ambitious measuring programme was carried out between 1999 and 2001 with a number of affected flats. This programme revealed the following:

During renovation work, organic compounds with a higher boiling point (softeners and other substances) are released into the room air, with some of these compounds becoming attached to existing airborne particulate matter. Small dust particles stick together, forming larger particles which accumulate as an oily/grease film on walls, ceilings and furniture. This is, however, only possible in the presence of further adverse effects, such as an elevated electrostatic charge potential in the flat, periodic heating pattern with radiators being occasionally turned off completely, inadequate ventilation, use of oil lamps or candles with a high soot release potential during winter, as well as additional softener emissions from furniture. This accumulation phenomenon occurs repeatedly in some flats. Although the current state of information suggests that there is no health hazard for the inhabitants, this condition can seriously affect the quality of living in some cases.

Softener-free products should be used whenever possible during renovation work. Some manufacturers already label their products as softener-free.

For further information on the "black flats" phenomenon, please refer to UBA's press release 45/2001, available on the Internet at: www.umweltbundesamt.de, under "Press Releases".

(II 2.3)

Microbial contaminations in indoor areas

The 8th WaBoLu indoor days that were held at UBA in May 2001 addressed the issue of microbial contamination. The adoption of this subject reflected the growing importance, in particular, of mildew and dry rot in indoor areas. The main cause of mildew is moisture in almost every case. Moisture can directly penetrate into masonry walls as a consequence of construction defects, Humidity in the room air condensates at cold spots on walls, for example, at thermal bridges. Moreover, condensation can also occur on surfaces if steam caused by activities in rooms (showering, washing, cooking, etc.) is not sufficiently discharged into the open. This can be a particular problem in densely sealed buildings. This then leads to a risk of mildew growing in hidden corners and wall areas.

This is why relative humidity should not exceed 65 to 70 % in rooms and 80 % directly along wall surfaces. Temporarily elevated levels are no problem if they are limited to short terms. Densely sealed buildings, in particular, require regular ventilation in order to keep relative humidity below these levels.

Buildings with clearly visible signs of mildew must be rehabilitated. If mildew is suspected in cases of hidden damage, on-site inspection is necessary. Experts should then analyse the exact extent of damage and develop rehabilitation recommendations. This often requires microbiological analyses.

UBA's Indoor Air Hygiene Commission is currently working on a guideline for mildew in buildings. This guideline is expected to be completed by August 2002. It will then be available from the Central Services Unit (address on page 109) *(II 2.3)*

Department II 3:

Water

Information material for the International Conference on Freshwater

The International Conference on Freshwater took place in Bonn in December 2001. UBA published two brochures on this occasion.

The publication "Water resources management in Germany" is a compilation of facts, figures and legal

information related to water management in Germany. This publication has a structure which follows that of the "water" chapter of Agenda 21 (refer to chapter 1) and is the fully revised 5th edition which is also considered as the national report on the implementation of the water management targets adopted in Rio de Janeiro in 1992. A two-volume appendix contains detailed information on pollutant immissions into waters and hence on water quality.

The documentation titled "German water sector – policies and experiences" is a compilation of concrete case studies related to water management in Germany. These cases include, for example,

- The water management measures for the river Ruhr dating back to the end of the 19th century
- The involvement and influence of citizen and environmentalist initiatives with regard to solutions to water management problems
- The involvement of private companies in communal waste-water and sewage disposal
- The planning of a dam
- International co-operation for the protection of the Rhine

The 150-page brochure was prepared by the Witten/Herdecke university.

"Water resources management in Germany" is published in English and German. "German water sector – policies and experiences" is published in English, German, Spanish and Russian. Free copies are available from UBA's Central Services Unit (address on page 109). The documentation is also available on the Internet at: www.umweltbundesamt.de/wasser.
(II 3.1, II 3.4)

Water resources management in Local Agendas

Although "Local Agenda 21" processes (refer to chapter 1) are firmly established in many municipalities, protection of waters is often a marginal issue. On behalf of UBA, the International Council for Local Environmental Initiatives (ICLEI) developed an Action Guide on "Sustainable water management and Local Agenda 21". Furthermore, an interactive website was launched at: www.wasser-agenda.de. The documentation provides many practical examples, as well as contact addresses and references. What's more, examples of activities related to the protection of waters, as well as literature references are offered. Visitors can also make their own entries. In this way, UBA has created the first contact point on the Internet for water resources management within the scope of the "Local Agenda 21".

Free copies of the Action Guide "Sustainable water management and Local Agenda 21" are available from UBA's Central Services Unit (refer to box on page 109). *(II 3.1)*

Water resources management promotion and subsidy programme

UBA has summarised the EU's promotion and subsidy offers in a brochure. This includes structural and regional support, the INTERREG III and URBAN II Community initiatives, the LIFE III programme, as well as the Fifth framework programme of the European Community for research, technological development and demonstration activities. The brochure describes, amongst other things, the types and financial endowment of the promotion and subsidy programmes, their contents and geographical coverage, qualification requirements, as well as principles of operation.

Free copies of the brochure "Förderprogramme der EU für den Bereich Umweltschutz, insbesondere Wasserwirtschaft" ["EU promotion and subsidy programmes for environmental protection, in particular, water management] are available from UBA's Central Services Unit (address on page 109). It can also be downloaded from the Internet at: www.umweltbundesamt.de/wasser.

Influence of different measures on floods

Land use, the condition of the vegetation cover, and climatically changed rainfall patterns have an influence on the discharge of rain water. These factors contribute towards floods and hence require adequate measures. In order to enable clear identification of cause and effects, the Potsdam Institute for Climate Impact Research has examined on UBA's behalf three characteristic, medium-sized areas with a surface of between 100 and 500 square kilometres.

The final report titled "Einfluss verschiedener Maßnahmen auf den Verlauf von Hochwasserereignissen" [Influence of different measures on the development of floods] is available on the Internet at:

www.umweltbundesamt.de/wasser under "Publications – Floods". It is also available on loan from UBA's library (address on page 2) under number UBA-FB 000162. (II 3.1)

Identification and evaluation of flood hazards and risks

The Internationale Kommission zum Schutz des Rheins (IKSR) [International Commission for the Protection of the Rhine], supported by UBA, has published an atlas with 1:100,000 overview maps of flood exposure and damage risks on the Rhine for all the neighbouring states. The hazard maps cover not just the flood areas, but include even those areas which were rarely flooded, if at all, in the past thanks to technical measures. Risks of damage both to property and to persons are shown.

The atlas is available from Internationale Kommission zum Schutz des Rheins (IKSR), Hohenzollernstr 18, 56068 Koblenz, Germany. (II 3.1)

Hydropower plants as renewable energy sources

The use of water power is an issue where different environmental protection interests are in conflict. In order to enable a differentiated balancing of water protection and climate protection aims, UBA has compiled and studied both legal and ecological aspects. The result: The smaller the power of a hydropower plant, and the more natural the condition of the water concerned, the lower the economic benefits and the climate protection effect, but the larger the ecological damage to the water. This is why UBA recommends that no new small hydropower stations should be built at natural waters, and that the power of existing power stations be maximised at large rivers. This should also be a focal point of government subsidies – for example, within the scope of the *Renewable Energy Sources Act (EEG)*.

"Wasserkraftanlagen als erneuerbare Energiequellen" [Hydropower plants as renewable energy sources] (TEXTE 01/01) is available from Werbung + Vertrieb (refer to box on page 109) (II 3.1, II 3.4)

Groundwater database

International conventions and directives oblige the member states to prepare regular reports on the condition of the environment. In order to simplify the process of reporting on the condition of groundwater, Federal-state governments have undertaken within the scope of an *Administration Agreement on the Exchange of Environmental Data between Federal Government and Federal-state Governments* to submit the measuring results of the 800 or so groundwater measuring stations to UBA on an annual basis. These results will form the basis for the reports to the European Environment Agency (EEA). Within the scope of a research project, the Berlin-based companies Fugro Consult and Risa Sicherheitsanalysen have developed an IT-platform-neutral groundwater database for the acquisition, checking and evaluation of this data. Besides the data from the groundwater measuring stations gathered for the EEA, this database contains data from around 180 measuring stations of the nation-wide nitrate measuring network that was set up pursuant to the *EC Nitrate Directive (Directive 91/676/EEC)*. Furthermore, the Federal states' reports on the results of the studies on plant protection agents in groundwater were also integrated into the database. The database went into regular operation in 2001 and is updated on a regular basis. *(II 3.1)*

Plant protection agents in groundwater

UBA regularly evaluates the data on plant protection agents that it collected by the Federal states within the scope of the groundwater monitoring programme. Active substances of plant protection agents which are frequently found in groundwater, as well as the metabolites of such substances, are compiled in an overview which is made available to the evaluation and approval agencies for plant protection agents.

The drinking-water limit value which is used as the evaluation basis for increased pollution levels is still often exceeded with atrazine and its metabolites. Other substances for which increased concentrations are frequently reported by the Federal states include bromacil, bentazon diurone, mecoprop, 1,2-dichloropropane, 2.6-dichlorbenzamide as well as simazin. *(II 3.1)*

Effects of plant protection agents on communities in waters

The use of plant protection agents in small flowing waters leads to a dramatic decrease in the share of susceptible species and the number of organisms of

Table 10: Active substances of plant protection agents found most frequently in groundwater

Year 2000
Revision: 21 December 2001

Active substance/ metabolite	Number of states	Number of measuring points				
		Examined total	Highest value per measuring point			
			Not detected-	Detected <= 0.1 µg/l	Detected > 0.1 µg/l	Relative frequency
Desethylatrazine	13	5,672	4,592	889	191	3.37 %
Bromacil	10	4,676	4,481	87	108	2.31 %
Atrazine	14	5,691	4,857	734	100	1.76 %
2,6-dichlorobenzamide	3	2,440	2,262	122	56	2.30 %
Bentazon	12	4,165	3,989	124	52	1.25 %
Hexazinone	10	4,356	4,238	80	37	0.85 %
Diuron	12	4,597	4,505	63	30	0.65 %
Simazine	14	5,611	5,350	233	28	0.50 %
1,2-Dichloropropane	4	372	343	4	25	6.72 %
Mecoprop	12	2,194	2,147	26	21	0.96 %
Desisopropylatrazine	9	5,095	4,949	126	20	0.39 %
Propazine	11	4,946	4,878	55	13	0.26 %
Terbuthylazine	11	5,285	5,237	37	11	0.21 %
Carbofuran	7	1,661	1,641	10	10	0.60 %
Desethylterbuthylazine	9	3,723	3,686	29	8	0.21 %
Metolachlor	11	4,473	4,437	29	7	0.16 %
Isoproturon	13	4,648	4,599	43	6	0.13 %
3,4-dichloranilin	3	166	158	3	5	3.01 %
Dichlorprop	12	2,139	2,126	8	5	0.23 %
MCPA	11	1,889	1,878	6	5	0.26 %

The column "Number of states" shows the number of Federal states where the corresponding active substance /metabolite was analysed in ground water.

such species. Species with multi-year reproduction cycles, in particular, occur less frequently in polluted waters because it is more difficult for them to recover compared to species with reproduction cycles of just a few months. No multi-year species at all were found in waters polluted by insecticides.

In a classification system with five water quality classes according to the *EU Water Framework Directive (WFD)* , the reference water with no agricultural use in its surroundings and not exposed to immissions of plant protection agents is classified as class 1 (high status). Non-polluted waters are classified as class 2 (good status), whilst polluted waters belong to class 4 (unsatisfactory). This shows that small flowing waters polluted with plant protection agents currently fail to reach the good condition to be achieved pursuant to the Water Framework Directive.

The final report by the Braunschweig Technical University titled "Pflanzenschutzmittelbelastung und Lebensgemeinschaften in Fließgewässern mit landwirtschaftlich genutztem Umfeld" [Plant protection agent exposure and communities in flowing waters in an environment with agricultural use] (TEXTE 65/01) is available from Werbung + Vertrieb (refer to box on page 109). (II 3.4).

Open cast mining lakes – requirements on water quality

Some of the many pits in former brown coal open cast mines will, once they are filled with water, be among Germany's largest lakes. A documentation which Brandenburgische Technische Universität prepared on behalf of UBA describes 230 of the 500 open cast mining lakes in terms of water chemistry and water biology, with the geographical situation, names and areas of the other lakes being mentioned.

Around half of the lakes are affected by acidification. This does not mean, however, that these lakes are dead. Very special communities form instead. Many open cast mining lakes have the potential to become clean, low-nutrient lakes. For a variety of reasons, filling these lakes with river water is often selected rather than filling them with rising groundwater.

"Tagebauseen in Deutschland – ein Überblick" [Open cast mining lakes in Germany – an overview] (TEXTE 35/01) is available from Werbung + Vertrieb (refer to box on page 109). (II 3.4)

Waste water from the textiles processing industry

The textiles processing industry generates waste water emissions which are sometimes problematic. Within the scope of a research project on the "Establishment of a water emissions inventory for the Federal Republic of Germany", emissions from the textiles processing industry were determined for different products and raw materials, and emission factors for waste-water emissions were calculated for different product groups. Furthermore, production-related raw material volumes – in terms of dyestuffs, as well as ancillary materials and basic chemicals for textiles – were determined for five textile processing companies. The results are summarised in Table 11 (page 125) and are proof that textile processing operations require large volumes of chemicals.

The study titled "Die gegenwärtige Verbrauchs- und Emissionssituation der deutschen Textilveredlungsindustrie" [The current consumption and emission situation in the German textiles processing industry] (TEXTE 28/01) is available from Werbung + Vertrieb (address on page 109). (II 3.2)

Immissions of phthalates into waters

Phthalates, i.e. the esters of phthalic acid, are among the most important industrial chemicals. These chemicals are produced in large quantities, for example, as softeners for plastic materials. Since phthalates are not chemically bound in plastic, they can gradually escape into the environment through-

Table 11: Emission factors for different substance groups and textiles processing companies

Type of textile processing operation	*Dyestuff [g per kg of fabric]*	*Textile additive [g per kg of fabric]*	*Basic textile chemicals [g per kg of fabric]*
Processing of yarn, mainly made of polyester	*18*	*129*	*126*
Processing of knitted fabrics, mainly made of synthetic fibres	*52*	*113*	*280*
Processing of knitted fabrics made of cotton	*18*	*100*	*570*
Processing of fabrics, mainly made of cellulose fibres	*11*	*183*	*200*
Processing of fabrics, mainly made of cellulose fibres, with a relevant printing share	*88*	*180*	*807*

Table 12: Applications of phthalates

Sector	*Application*	*Phthalate*
Paints, lacquers and varnishes	*Flexibilisation of pains, lacquers and varnishes*	*DEHP, DBP, DIBP, DINP*
Leather and textile coating	*Softeners for textile coating for PVC*	*DEHP*
Adhesives	*Flexibilisation of adhesives*	*DEHP, DBP, DIBP, DINP*
Leather and shoe industry	*PVC-based soles*	*DEHP, DINP*
Plastic-processing industry	*Softener for PVC*	*DEHP, DBP, long-chain phthalic acid esters*
Construction industry	*Softeners for roof covering, sections, floor coverings, wallpaper on PVC-basis*	*DEHP, DINP, long-chain phthalic acid esters*
Sealing compounds	*Softeners for PVC-based based sealing compounds*	*DEHP, DINP, long-chain phthalic acid esters*
Cable industry	*Softeners for cable sheaths and cable insulation*	*DEHP, DINP, long-chain phthalic acid esters*
Sports and leisure articles	*Softeners for plastisol applications, such as tent fabrics, swimming-rings, rubber dinghis and fenders*	*DEHP, DINP*
Garden and landscape design	*Softeners for greenhouse foils*	*DINP, long-chain phthalic acid esters*
Toy manufacturers	*Softeners for PVC injection-moulding articles and PVC plastisols, such as dolls*	*DINP*
Furniture and wood processing	*Softeners for PVC furniture foils*	*DINP*

DEHP – diethylhexylphthalate, DBP – dibutylphthalate, DIBP – diisobutylphthalate, DINP – diisononylphthalate

out the entire life cycle of plastic materials. Phthalates are found in all environmental media. Table 12 gives an overview of the applications of different phthalates.

Within the scope of the Environmental Research Plan (UFOPLAN), the state environmental agency of North-Rhine Westphalia determined the contents of phthalates in waters and their main immission paths as a basis for determining the relevance of reduction measures.

One of the results of these efforts was that concentration has remained relatively stable for several years, and that concentration is influenced by the industrial and population density. A long-term reduction

of phthalates in the environment can only be achieved by discontinuing their use.

The study titled "Untersuchungen zu Phthalaten in Abwassereinleitungen und Gewässern" [Studies of phthalates in waste water immissions and waters] (Texte 31/01) is available from Werbung + Vertrieb (box on page 109). *(II 3.2)*

Synthetic complex-forming substances in waters

Complex-forming substances form part of many cleaning, detergent and industrial agents. Their functions include the binding of excess metal ions and the loosening of not easily detachable deposits. Although complex-forming substances do not belong to the primary substances with an adverse effect on health, these compounds often feature low decomposition rates and are hence found in surface waters. The Wiesbaden-based Institut für Wasserforschung und Wassertechnologie GmbH (ESWE) was commissioned by UBA to determine data (including, for example, production volumes, applications, environmental behaviour) for selected complex-forming substances, such as aminopolycarboxylates, organic phosphonates and hydroxycarboxylates. The institute examined analytical methods for these substances and developed recommendations for reducing their immissions into waters. Alternative products with better biological decomposition behaviour are today available for certain applications. Such products include, for example, ethylene diamine disuccinate (S,S-EDDS), imino disuccinic acid (IDS) or alanine diacetic acid (ß-ADA) which were also studied within the scope of this project.

The study titled "Einträge synthetischer Komplexbildner in die Gewässer" [Immissions of synthetic complex-forming substances into waters] (TEXTE 03/02) is available from Werbung + Vertrieb (box on page 109). *(II 3.2)*

Assessment of pollutant burden trends in rivers

Trend assessments can be used to determine whether reduction measures at point sources and diffuse sources in a river basin also helped reduce immissions from the river into the sea. These "river burdens" depend on numerous factors, including outflow rates and climatic factors, and must hence be adjusted in order to avoid a distortion of results due to such influences. In a research project for UBA, Freie Universität Berlin developed a methodological concept for adjusting and analysing the trends of river burdens.

"Trend methods for the assessment of effectiveness of reduction measures in the water system" (TEXTE 80/01) is available from Werbung + Vertrieb (box on page 109).

European Pollutant Emission Register (EPER) in Germany

In future, the EU Commission will provide information on pollutant emissions into the air and water from industrial facilities within the scope of the European Pollutant Emission Register (EPER). For this purpose, member states will be obliged as of June 2003 to report to the EU Commission every three years the emission data from around 20,000 industrial plants all over Europe. The EPER will cover emissions of up to 50 pollutants, including climate gases, heavy metals and organic pollutants. For the first time ever, conventional reports and the Internet will give the general public throughout Europe an overview of pollutant emissions from industrial plants into the air and water.

A demanding pan-European project of this kind requires considerable preparation – not just on the part of the EU Commission, but also in the member states. One important criterion for the EPER is that it must be really possible to effectively compare the data throughout Europe.

This is the purpose of the EU Commission's *Decision 2000/479/EC on the implementation of a European pollutant register (EPER) according to Article 15 of Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC)* which sets first standards.

UBA has been accompanying the development and implementation of the EPER since 1999 with two research projects which are being carried out by the State Institute for Environmental Protection Baden-Württemberg (LfU).

The "Leitfaden zur Umsetzung des Europäischen Schadstoffregisters (EPER) in Deutschland" [Guideline for the implementation of the European Pollutant

Register (EPER) in Germany] (TEXTE 50/01) is available from Werbung + Vertrieb (box on page 109). Further information and discussion forums are available on the Internet at: www.eper.de. This website is hosted jointly by UBA and the LfU. (II 3.1)

North Sea and Baltic Sea measuring programme by the Federal and Federal-state governments

International quality requirements for marine environmental data are contingent upon the availability of validated analytical and determination methods. The national institutions and laboratories involved in the North Sea and Baltic Sea measuring programme of the Federal and Federal-state governments (BLMP) hence adapted their internal quality assurance systems to the requirements of the new DIN EN ISO/IEC 17 025 standard and took part in established international programmes for external quality assurance. The BLMP quality assurance unit at UBA co-ordinates these activities. Work in 2001 focused on the implementation of a quality assurance system for biological parameters and the identification of the data quality of the chemical monitoring parameters. This work included:

- Comparative laboratory analyses in order to determine the comparability of sampling and sample preparation methods
- Intercomparison programmes for biological parameters (macrozoobenthos, phytoplankton) as well as the development of standardised lists of phytoplankton and macrozoobenthos species
- Joint workshops on methodology and quality assurance in marine monitoring

In order to verify the correctness and comparability of the chemical monitoring data gathered, the BLMP laboratories took part in the international QUASIMEME (**Q**uality **A**ssurance of **I**nformation for **M**arine **E**nvironmental **M**onitoring) programme for external quality assurance in marine monitoring. The results of this programme show that the analytical methods adopted by the BLMP are correct and precise. The laboratories turned out to be very efficient when it came to determining nutrients, heavy metals and organic pollutants in sea water, sediments and biota.

A firmly established quality assurance system is not yet in place for the biological parameters of the BLMP (phytoplankton, macozoobenthos, macrophytobenthos). This means that efforts are all the more important in order to check and, as far as possible, improve the comparability of the biological data monitored by the BLMP. Apart from intercomparison programmes and efforts to promote the development of methods, this is achieved by the extensive exchange of experience and regular staff training courses and workshops.

Reports on laboratory comparisons and workshops carried out in 2001 are available from the Quality Assurance Unit of the BLMP, c/o Umweltbundesamt, Unit II 3.5 Grundwasser und Hydrologie [Groundwater and Hydrology]. This information, as well as further details are also available on the Internet at: www.umweltbundesamt.de/wasser. (II 3.5/II 3.3)

How comparable are water samples?

In a European intercomparison programme with 4 participants from 11 countries, two standards developed by the Technical Committee 292 of the European Committee for Standardization (CEN/TC 292 "Characterization of wastes") were validated.

- *DIN V ENV 12506 analysis of eluates – determination of pH, As, Cd, Cr (VI), Cu, Ni, Pb, Zn, Cl^-, NO_2^-, SO_4^{2-} as well as*
- *DIN V ENV 13370 analysis of eluates – determination of ammonium-N, AOX, conductivity, Hg, phenol index, TOC, CN^- easily purgable, F^-.*

For this purpose, synthetic **ELUATES** as well as eluates from contaminated soils, sewage sludge, sandblasting waste and fly ash were sent to the participants in order to find out whether the methods that were originally developed for analysing water (surface, drinking, ground and waste) samples can also be used to monitor tasks in conjunction with the implementation of the *Council Directive on the landfill of waste (Directive 1999/31/EC)*. The process characteristics (repetition and reference precision) were determined. An analytical method was considered suitable if it met with the following criteria:

- Results from a minimum of six laboratories
- At least 18 results following elimination of freak values
- "Freak share" of less than 25 %
- Relative repetition standard deviation of less than 15 %
- Relative reference standard deviation of less than 40 %

Despite the fact that the number of laboratories that took part was too low for all the combinations of parameters and methods, and despite the fact that the correct measurement of individual elements was not possible in some eluates because of very low concentrations, one can still say that most of the methods examined are suitable for the application for which they are intended.

Free copies of the final report on the intercomparison programme are available from Unit II 3.6, Laboratory for water analyses, (address on page 2). *(II 3.6)*

Eluates: *Aqueous solutions resulting from substances washed out from solid matter. The process is called elution (from Latin eluere = washing out).*

Hazardous substances in industrial waste water

Immissions of industrial waste water into surface waters and the seas is a major path of immissions of hazardous substances into the aquatic environment. The *EU Framework Directive on Water Policy (Directive 2000/60/EU)* demands that immissions of priority substances be reduced "to zero".

Within the scope of the Environmental Research Plan (UFOPLAN), UBA commissioned the Department for Water Quality Control at Technische Universität Berlin to develop a proposal for an assessment strategy. The proposed assessment strategy, IDA (**I**ndustrial **D**ischarge **A**ssessment), was subsequently tested on the basis of the examples of three waste-water immissions by chemical and metal-processing companies.

The results showed that the assessment strategy can be applied as planned, and that it is capable of supplying sensible statements on the quality of immissions as well as appropriate measures. The IDA approach enables both monitoring authorities and companies to assess the potential hazard of the immissions in question and to implement suitable reduction measures. This strategy can be a preferred instrument in immission approval procedures both before and after changes in industrial production or waste-water treatment processes.

The study titled "Untersuchungsstrategie für gefährliche Stoffe in Abwassereinleitungen der Industrie" [Assessment strategy for hazardous substances in waste-water immissions from industry] (TEXTE 07/01) is available from Werbung + Vertrieb (box on page 109). *(II 3.2)*

Department II 4:

Drinking-water and swimming-pool water hygiene

New approach towards drinking-water monitoring

The World Health Organization (WHO) offered its first drinking-water quality guidelines in 1984/85. These guidelines are revised around every ten years. Although these *WHO drinking-water guidelines* are recommendations only and explicitly state that national standards and guidelines must be adapted to local conditions, these guidelines nevertheless set standards. Although only a few nations have adopted less restrictive statutory requirements, shortcomings are often found at the implementation level. As the knowledge of microorganisms and substances in drinking water that can pose a potential hazard to human health increases, the list of parameters for which orientation values and monitoring methods exist is growing.

This leads to requirements which developing and newly industrialized countries, in particular, find difficult to cope with. On the other hand, countries with hygienic standards comparable to those in Germany are in danger of becoming "over-regulated". There is also a general concern in Germany that more global monitoring aspects are increasingly neglected at times when money is tight. These aspects include local inspections and comprehensive status-quo analyses on the basis of detailed knowledge of systems and locations.

In view of this situation, new ground will be broken within the scope of the current revision of the WHO's drinking-water guidelines. Rather than focusing on limit or orientation values for individual parameters, comprehensive analyses of complete supply systems are to be carried out in order to identify possible weaknesses. For this purpose, the HACCP concept from food hygiene is adapted to the needs of drinking-water monitoring. The aim is to develop a **H**azard

Analysis that is tailored to every single water supply system and to focus on **C**ritical **C**ontrol **P**oints which are representative for the functioning of the processes. Although the WHO will continue issuing guidelines for monitoring the "drinking water" product, the focus will, however, be shifted away from these guidelines and the orientation values for individual parameters.

The advantage of this approach is the integrated view – from the catchment area to the consumer – together with improved co-operation of the part of all the parties concerned. Furthermore, this approach means greater flexibility in responding to the characteristics of every single case. Australia has already implemented this approach by adopting the *Drinking Water Framework* in May 2001. Although Germany has not yet adopted the HACCP terminology, it is very likely that Germany's drinking-water supply with its very high protection level is already based on these principles in many respects.

HACCP does not replace best practices or hygienic practices, but is based on these. For drinking-water supply, this includes, for example:

- Multi-barrier systems
- Documentation of principles and practices from the catchment area to the consumer
- Best resource management practices
- Best engineering practices
- Best operating practices (including written principles for maintenance, service and operation of plants and facilities, as well as protection of the catchment area)
- Ongoing training in best practices
- Clearly defined and transparent procedures for site inspections
- Inspection and best laboratory practices

Within the framework of these basic requirements, HACCP is regarded as a tool for identifying, evaluating and controlling health hazards and hence as a quality management tool.

Although orientation or limit values still play a role in product control, they are no longer the focus of monitoring measures. What is seen as the particular advantage of HACCP is the fact that more detailed rules and definitions are laid down for process monitoring at the critical points in the system – from the resource to the consumer – so that increased attention is devoted to these most critical points.

UBA's drinking-water department is involved in this development as part of its function as a WHO Collaborating Centre, and in 2002 will focus on promoting the debate on the applicability of HACCP in Germany. *(II 4.3)*

WHO Collaborating Centre for Research on Drinking-Water Hygiene

The WHO's Collaborating Centre for Research on Drinking-Water Hygiene (WHO CC) hosted by UBA is one of three German centres working within the WHO's "Environment and Health" programme.

One of the tasks of the WHO CC is to offer advice and support to the successor states of the Soviet Union with regard to drinking-water problems. On behalf of the WHO's European Centre for Environment and Health, the WHO CC is currently co-operating with Tajikistan's health authorities responsible for drinking-water quality. Since its independence in 1991, this central Asian country has been experiencing the return of diseases, such as typhoid fever, which originate from water. This co-operation is hence aimed at analysing the causes for the re-occurrence of these diseases and at giving Tajikistan's public authorities better tools for monitoring microbiological drinking-water parameters.

Tajikistan is one of central Asia's main cotton growing regions. Since large amounts of plant protection agents are used in cultures like this, the top priority is a nation-wide analysis programme in order to determine the pollution of drinking-water resources with chloroorganic plant protection agents.

Data from the years up to 1991 show that plant protection agents were applied at annual rates of up to 48 kilogrammes per hectare. Up-to-date information on concentrations of plant protection agents in groundwater and surface waters is currently not available because both health and environmental authorities lack the capacities needed to analyse plant protection agent contamination. The WHO CC supports the programme currently underway by providing laboratory equipment, training personnel and analysing samples in the laboratory of UBA's Bad Elster branch. The results will be used for an initial assessment of the contamination situation. They will form the basis for a strategy for the future handling of plant protection agents in Tajikistan. Workshops with participants from the

fields of agriculture, water supply and public health will support this process. *(II 4.1, II 4.3)*

Revision of the Drinking Water Ordinance

On the basis of the *EC Drinking Water Directive (Council Directive 98/83/EC on the quality of water intended for human consumption)*, the *Federal Law on Epidemic Control (IfSG)* as well as the *Federal Law on Foodstuffs and Commodities (LMBG)*, the Bundesrat agreed on 21 May 2001 to the *Ordinance on the Revision of the Drinking Water Ordinance* which is to come into effect on 1 January 2003.

This marked the end of a long and difficult co-ordination process at both European and national level, constituting a crucial step towards the implementation of the EC Drinking Water Directive whilst at the same time ensuring that the high quality level of German drinking-water supply will be maintained. UBA's Drinking Water Commission (TWK) has a central role to play in this effort. The ordinance considers the progress of scientific and technical knowledge over recent years. It determines a clear structure of responsibilities on the part of water supply companies and monitoring authorities, thereby improving health protection for consumers significantly. Under the new ordinance, consumers are entitled to demand and receive up-to-date and comprehensive information concerning the quality of the water supplied to them.

In the field of preventive health protection, for example, the limit value for lead in drinking water has been lowered from 40 microgram per litre (µg/l) to 10 µg/l. However, as a condition for the lower limit value to be adhered to, lead may no longer be used as a material for drinking-water pipes. This means that lead pipes must be replaced in drinking-water supply networks to a large extent in the years to come. *(II 4.1)*

Work results on the microbiology of drinking water

Since 1998, the "Microbiology Work Group" as a standing group of the Drinking Water Commission (TWK) has been working on epidemiological problems related to drinking-water quality. The group is managed by UBA's "Microbiology of Drinking-water and Swimming-pool Water" unit.

Work during the 1998 to 2001 period focused on microbiological issues in conjunction with the development of the new *Drinking Water Ordinance (TrinkwV 2001)*. The most recent subject was the development of accreditation requirements for laboratories for microbiological drinking-water analyses.

Furthermore, recommendations with a microbiological background were developed for the drinking-water commission and published in the Federal Health Gazette. These recommendations concerned, in detail:

- Requirements for the treatment of surface waters to drinking water with a view to the elimination of parasites (Federal Health Gazette 12/1997)
- Detection of legionella in drinking water and swimming-pool water (Federal Health Gazette 11/2000)
- Recommendations for the avoidance of drinking-water contamination with parasites (Federal Health Gazette 4/2001)
- Pseudomonas recommendation (Federal Health Gazette 2/2002)
- Intercomparison programme recommendation (Federal Health Gazette 3/2002)

The Federal Health Gazette is published by Springer Verlag, Heidelberg, and is available from specialist bookstores. (II 4.6)

Pathogens as a hygienic risk

The *EU Drinking Water Directive* explicitly demands that microorganisms and parasites in drinking water may not occur in concentrations that endanger human health. This claim represents the precise form of the familiar requirement of the Drinking-water Ordinance pursuant to which drinking water must be free from pathogens, taking the far-reaching consequences for drinking-water production, processing and distribution into consideration.

Water supply systems using surface waters exposed to waste water or agricultural immissions as drinking-water sources hence require special attention with a view to pathogen burdens.

Recent findings suggest that disinfection alone is not a safe "barrier" against certain pathogens (such as permanent parasites, viruses) in drinking water produced from surface waters. Not all of these microorganisms are detected by the indicator system used for monitoring. In the case of surface waters with faecal contamination, for example, one must expect pathogens to contaminate the drinking water, in particular, under unfavourable weather conditions and with insufficient treatment processes.

In order to avoid this, it was and still is necessary to avoid or minimise any exposure of raw water to such organisms in addition to optimum drinking-water treatment processes. Raw water in drinking-water reservoirs, which are often located in catchment areas subject to intensive human use, require special attention in this context. Pathogen contamination of raw waters of this kind is thus likely to occur.

The drinking-water reservoirs in Saxony and Thuringia which supply up to 60 % of the population with drinking water and which are in most cases characterised by multiple uses (agriculture, settlement, industry) and hence sources of contamination in their vicinity thus require special care when it comes to setting up protection zones for drinking-water reservoirs.

Knowledge of contamination and potential immission paths of pathogenic microorganisms is a must. A reassessment of the microbial burdens of rivers feeding drinking-water reservoirs is urgently needed. To this effect, the extent of microbial contamination of drinking-water reservoir systems with different catchment areas in Saxony and Thuringia was analysed within the scope of a research project. The drinking-water reservoir authorities of the Federal states of Saxony and Thuringia, the Ministries for the Environment of the Federal states of Saxony and Thuringia, as well as the Siegburg-based "Arbeitsgemeinschaft Trinkwassertalsperren" society were commissioned with this research.

Results: During the term of the project, a total of 630 examinations were carried out in nine drinking-water reservoir systems (489 examinations of feeding rivers, 141 raw-water samples) with regard to the following microbiological parameters:

- *E. coli*/coliform bacteria
- Faecal streptococcus
- *Clostridium*
- Salmonella
- *Campylobacter*
- Yersinia
- *Cryptosporidium* oocysts
- *Giardia c*ysts
- Coliphages

Permanent parasites were found in 89 % of the water samples from all the feeding rivers of the drinking-water reservoirs. Point loads (communal and/or agricultural emissions) were found in the feeding rivers.

The studies showed that *giardia c*ysts accounted for a larger share than *cryptosporidium o*ocysts in settlement waste water. In contrast to this, higher concentrations of *cryptosporidium o*ocysts were found in the case of pastures and agricultural waste waters (from stables, for example).

Permanent forms of parasites were also found in feeding rivers originating in catchment areas with forests. The likely source of immissions into waters is faeces from game in this case.

In the case of agricultural sources, a difference exists between waste water from cattle farming in stables and water runoff from pastures. Higher values were measured primarily in cases of intensive pasture farming with cow herd pastures reaching right down to the water.

Furthermore, exposure also varied in response to seasonal and meteorological conditions (high water, melting snow, strong rain). In rainy autumn weather and in spring, peak contaminations were found whilst the number of permanent forms of parasites detected declined during dry summer months.

Permanent forms of parasites were found in three of the drinking-water reservoirs studied (39 % of raw-water samples).

Based on the data gathered on the permanent forms of parasites, i.e. *cryptosporidium* oocysts and *giardia* cysts, contamination ranges can be defined (with the mean values as classification criterion) as follows:

- **Heavily contaminated feeding rivers:** *Giardia:* more than 100 cysts per 100 litres (l), *cryptosporidium:* more than 50 oocysts per 100 litres
- **Contaminated feeding rivers:** Giardia: 10 to 100 cysts per 100 l, cryptosporidia: 10 to 50 oocysts per 100 l
- **Non-contaminated feeding rivers:** Giardia: less than 10 cysts per 100 l, cryptosporidia: less than 5 oocysten per 100 l
- **Raw waters:** Giardia: less than 5 cysts per 100 l, cryptosporidia: less than 1 oocyst per 100 /l.

Parallel to the analyses of water samples for permanent forms of parasites, bacteriological parameters were determined, including the detection of bacterial pathogens (salmonella, campylobacter, yersinia) in different concentrations in the feeding rivers of drinking-water reservoir systems.

No thermophilic *campylobacter species* (*c. jejuni, c. coli*), were found in the raw waters. However, *arcobacter* (thermotolerant *campylobacter,* with some pathogenic species causing diarrhoea) and occasionally yersinia were found.

No correlations between permanent forms of parasites and bacteriological indicator parameters (*e. coli*, coliform bacteria, faecal streptococcus, *clostridium* and coliphages) as well as pathogens (salmonella, *campylobacter,* yersinia) in the water samples of feeding rivers and raw waters were found.

However, permanent parasite forms were found even though the above-mentioned bacteriological indicator parameters were not detected.

Conclusions: Permanent forms of parasites (*giardia* cysts and *cryptosporidium o*ocysts) and bacterial pathogens communicable in water are widely found in the environment (liquid manure, waste water, animal faeces) and in rivers feeding drinking-water reservoir systems (surface waters).

Pathogens were detected in the feeding rivers in varying concentrations, depending on the catchment area and its use, as well as on seasonal and meteorological conditions.

The partially heavy contamination of the water samples can be attributed to both animal farming and immissions of communal waste waters into the waters of the catchment areas. Resource protection measures are the first stage of the multi-barrier system designed to secure drinking-water supplies from surface waters. This means that the following hygienic safety aspects are relevant for the production of drinking water from reservoirs:

- Effective protection of raw-water resources against microbial contamination from waste water, agriculture and animal farming emissions is very important. The identification of protected areas and compliance with the applicable restrictions on the part of users of protected areas (e.g. ban on the use of liquid manure on fields in protection zone II, compatible forms of animal farming) is a priority requirement for the protection of drinking-water resources in reservoirs.
- Knowledge of contamination sources and immission paths of pathogenic microorganisms into drinking-water reservoir systems must be strictly applied to the epidemiological requirements within the scope of the requirements for protected areas.
- If all the criteria of the multi-barrier system are adhered to (resource protection, effective drinking-water processing using state-of-the-art processes, efficient monitoring of drinking-water production, processing and distribution processes) the quality of drinking water from an epidemiological point of view can be ensured even with regard to permanent forms of parasites.

"Requirements for the treatment of surface waters to drinking water with a view to the elimination of parasites" in: Federal Health Gazette 12 (1997), pages 484 and following. "Recommendations for the avoidance of drinking-water contamination with parasites" in: Federal Health Gazette 4 /2001, pages 406 and following., Springer Verlag Heidelberg, available from specialist bookstores. *(II 4.6)*

Organotin compounds in drinking-water pipes

In conjunction with the development of harmonised European standards for drinking-water materials (EAS), installation pipes made of rechlorinated polyvinyl chloride (PVC-C) were analysed. The suitability of the migration test method according to the preliminary prEN 12873-1 standard of the European

Committee for Standardization was to be checked and compared to the German *Recommendations on the use of plastic and other non-metal materials for the drinking water sector (KTW recommendation)*. The parameters selected for the comparison were the total content of organic carbons and organotin compounds. At the same time, the possible release of organotin compounds, which serve as thermal stabilisers in plastic materials, into drinking water was to be assessed.

In line with the E DIN 38407-13 draft standard, organotin compounds were determined following derivatisation with sodium tetraethyl borate by means of gas chromatography using a mass-spectrometric detector. The total organic carbon (TOC) content was measured in accordance with DIN EN 1484. The parameter concentrations measured in the migration samples were converted to migration rates via the contact time and the surface-to-volume ratio of the specimens in order to be able to compare them to the maximum tolerable migration rates for drinking-water pipes.

The Stuttgart Institute for Chemical and Veterinary Analyses additionally measured the contents of the individual organotin compounds in the plastic material and made the results available to UBA.

Figures 22 and 23 (page 132) and Table 13 (below) show some of the results obtained for the decomposition products of the original organotin compounds which are produced during the stabilisation process.

Substantial quantities of dibutyltin dichloride were found in the material sample produced on 22 February 1995 even though butyltin compounds are not

Table 13: Organotin compounds in drinking-water pipes made of PVC-C

The abbreviations stand for the following compounds:

Monomethyltin trichloride ($MMTCl_3$)
Monooctylltin trichloride ($MMTCl_3$)
Monobutyltint richloride ($MBTCl_3$)
Tributyltin chloride (TBTCl)
Dimethyltinn dichloride ($DMTCl_2$)
Dioctyltin dichloride ($DMTCl_2$)
Dibuttyltin dichloride ($DMTCl_2$)
Sn: tin

Dimension *Date of manufacture*	*50×5.6* *07.11.91*	*OTC* *in %*	*50×5.6* *22.02.95*	*OTC* *in %*	*63×7.1* *28.10.99*	*OTC* *in %*	*63×7.1* *02.02.00*	*OTC* *in %*
$MMTCl_3$ as Sn in mg/kg	*n.n.*	–	*n.n.*	–	*0.9*	*0.1*	*0.4*	*< 0.1*
$MBTCl_3$ as Sn in mg/kg	*0.8*	*0.1*	*2.2*	*0.1*	*n.n.*	–	*n.n.*	–
$MOTCl_3$ as Sn in mg/kg	*132.7*	*11.8*	*103.6*	*5.1*	*65.8*	*3.6*	*77.7*	*4.2*
$DMTCl_2$ as Sn in mg/kg	*n.n.*	–	*n.n.*	–	*13*	*0.7*	*14.0*	*0.8*
$DBTCl_2$ as Sn in mg/kg	*2.8*	*0.2*	*161.1*	*7.9*	*4.3*	*0.2*	*5.5*	*0.3*
$DOTCl_2$ as Sn in mg/kg	*986*	*87.9*	*1,769*	*86.8*	*1,740*	*95.4*	*1,740*	*94.7*
TBTCl as Sn in mg/kg	*n.n.*	–	*2.1*	*0.1*	*n.n.*	–	*n.n.*	–
Sum of all organotin compounds as Sn in mg/kg	*1,122.2*	*100*	*2,038*	*100*	*1,823.9*	*100*	*1,837.6*	*100*

permitted in Europe as stabilisers for plastic materials used in the food and drinking-water sectors. Monobutyltin trichloride and tributyltin chloride were also found in this pipe. Both compounds are probably impurities of the dibutyltin compound.

Figure 22 shows the reduction of migration rates in the cold-water test at 20°C. Similar curves were also measured during tests at elevated temperatures. The concentrations measured were in the nanograms per litre (ng/l) range.

The strong decline of migration rates shows that the inner surface of the pipes releases residues of stabilisers into the drinking water for a very short time only following installation of new pipe systems. No migration of organotin stabilisers from the piping material itself is to be expected.

Figure 22: Cold-water test

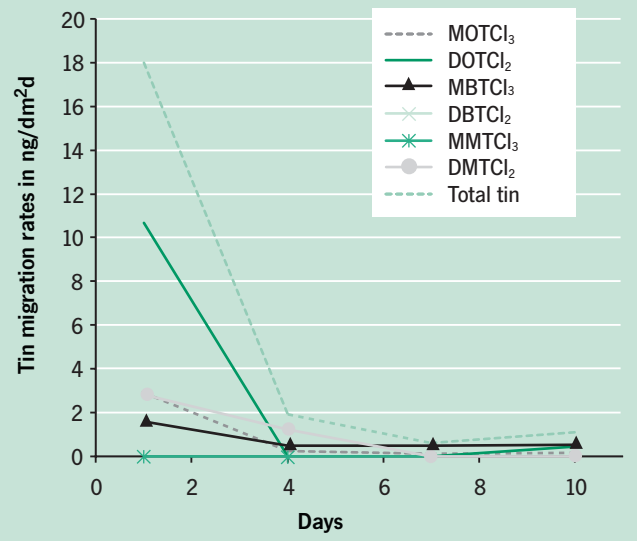
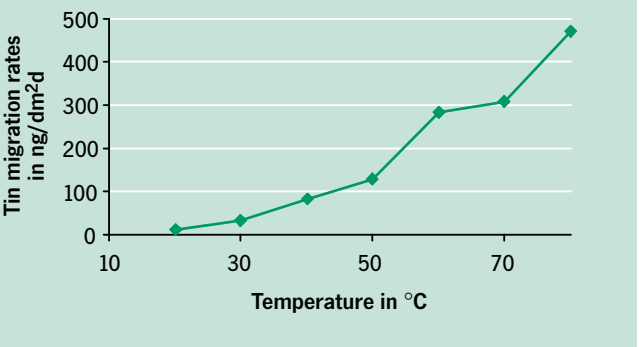


Figure 23: Temperature-dependent migration rates for residues of organotin stabilisers



When the results for the four study periods (total of ten days of contact with test water) are summed up and plotted as a function of temperature, one obtains the curve shown in Figure 23. This suggests that migration rates are higher in heated drinking water.

The results of TOC measurements at the migrants obtained showed that the trigger value of the KTW recommendations of 0.025 milligram per cubic decimetre per day (mg/dm²d) for the total organic carbon content is adhered to.

The assessment of the health risk suggested that the maximum tolerable migration rates were adhered to in all tests. This means that the PVC-C pipes with organotin stabilisers which were analysed in this test do not pose a health risk. The migration test method laid down in prEN 12873-1 was found to be suitable for checking the requirements for plastic materials for drinking-water applications. *(II 4.5, II 4.2)*

Reinforced hoses for household installation

Reinforced hoses are used today almost throughout for connecting sanitary fittings to drinking-water pipes. These flexible hoses consist of an inner rubber core (i.e. the real hose) surrounded by a stainless-steel fabric. Numerous problems (black particles or green slimy flakes in drinking water, leakage) suggest that these elements are questionable from a hygienic point of view. Several reports by the Federal Institute for Materials Research and Testing (BAM) and UBA's own studies have demonstrated the insufficient material qualities of the inner rubber hoses. Even before consumers become aware of these problems, strongly elevated colony counts can occur in the drinking water as a result of bio-films on the inner surface of the hose. These bio-films release organic matter, bacteria and bacteria clusters to the drinking water and also offer an ecological niche, for example, for amoebia in which legionella can grow.

This induced UBA to organize specialist talks with experts in the field of drinking-water biology and BAM experts. The results of these talks suggest that materials are not sufficiently subjected to microbiological

testing prior to their use for drinking-water applications, with the result of a potential hazard to human health. UBA then called upon the German Technical and Scientific Association on Gas and Water (DVGW) not to grant the DVGW quality label in future unless microbiological suitability has been demonstrated in accordance with DBGW document W 270.

Although the professional associations of the plumbing sector as well as industrial associations and the German Association of Engineers (VDI) as well as the Federal states' public health agencies were informed, UBA has received reports that problems with hoses have occurred in further cities. *(II 4.5, II 4.6)*

Department II 5:

Soil

"De-sealing" of soils

In order to study the legal conditions or de-sealing regulations pursuant to Article 5 of the *Federal Soil Protection Act (BBodSchG)* and to develop suitable soil protection requirements for the protection and restoration of soil functions, UBA commissioned the law firm of Gaßner, Groth, Siederer und Coll., Berlin, in co-operation with the Hannover-based Ökologie + Umwelt planning group and the Institute for Pedology of Universität Hamburg with a research project.

Pursuant to *Article 5 of the Federal Soil Protection Act*, the Federal government can issue legal regulations which oblige property owners to protect or restore the efficiency of soils to the maximum extent that can be reasonably demanded. This is applicable to land where use has been permanently discontinued and where its sealing would be in conflict with development law.

The legal part of the study contains, amongst other things, a definition of the scope of a potential *De-sealing ordinance pursuant to Article 5, section 1, sentence 1 of the Federal Soil Protection* Act, as well as a definition of those who can be obliged to de-seal soils or to tolerate the de-sealing of soils, plus a definition of relevant types of sealing and the constitutional limits for an obligation to de-seal soils.

Another research project addressed the question as to which legal and technical soil protection conditions must be taken into consideration for the purposes of a de-sealing ordinance pursuant to Article 5 of the *Federal Soil Protection Act*. As a result of this programme, the BMU and UBA jointly performed a "De-sealing planning game" in order to give officers at Federal-state and communal administrations the opportunity to comment on the preconditions for a prospective legal regulation pursuant to Article 5 of the *Federal Soil Protection Act* from a practical perspective on the basis of concrete case studies. *(II 5.1)*

Data processing for soil protection and contaminated sites

In April 2001, the 2nd workshop for IT-based applications in soil protection and in the field of contaminated sites was held at UBA. Experts from the several environmental agencies of the Federal states, public authorities and public institutions presented joint technical approaches. Soil protection is an interdisciplinary and integrated challenge. One important conclusion of the workshop in this sense was that the data and evaluation methods available at many levels need to be exchanged and networked in the interest of efficient soil protection and tackling the issue of contaminated sites. Efficient ways to ensure this include the further development of existing co-operation programmes and the launching of joint projects.

The documentation titled "2. UBA-Workshop" [2nd UBA workshop] (TEXTE 46/01) is available from Werbung + Vertrieb (box on page 109). (II 5.2 II 5.3)

Remote sensing and geographical information in the Berlin-Brandenburg region

UBA organized a meeting with the Berlin-based Berlin-Brandenburg remote sensing work-group on 3 December 2001. Representatives of the specialist public agencies of the Federal government and Federal-state governments located in the Berlin-Brandenburg region, as well as representatives of specialist companies and research institutes discussed general ways of co-ordinating activities and bundling competence in the field of remote sensing and geographical information. Issues of improved information exchange also played an important role.

The concise documentation titled "Arbeitsgespräch zur Koordinierung und Bündelung der Aktivitäten auf

dem Gebiet der Fernerkundung ..." [Talks on co-ordinating and bundling activities in the field of remote sensing] is available from Unit II 5.2 Bodenzustand, -funktionen und -nutzen [Soil condition, functions and uses] (address on page 2).

European soil protection

Wide-spread soil pollution and small-area contamination with historical pollution are very common in many central and eastern European countries. The most serious soil protection issue in southern Europe is the erosion of agricultural land. Acidification of forest soils continues to be the most important soil problem in northern Europe. The European Soil Forum (ESF) discusses ways to tackle these challenges in a united Europe as one of its major issues. After the first ESF organized by Germany in 1999 (refer to the 2000 Annual Report), Italy organized the 2nd forum in October 2001. Besides the EU Commission, the European Environment Agency also addresses this set of issues. A new European Topic Centre (ETC) was established to this effect in summer 2001, dealing with issues of land cover and coast protection as well as soil protection. This centre is managed by the University of Barcelona, Spain.

Further information on soil protection in Europe can be found on the Internet at: europa.eu.int/comm/environment/agriculture/consultation2.htm and terrestrial.eionet.eu.int. (II 5.2)

The STARS and XUMA-A^{MOR} databases

The revised and amended version 3.0 of the **St**offdatenbank für umwelt- und **a**ltlasten**r**elevante **S**toffe (STARS) [Database of substances relevant for the environment and historical pollutions] is now available on CD-ROM. The list of substances was amended from around 1,000 by another 150 substances, and the features of these substances were amended and updated with additional data. The November 2001 revision of "STARS 3.0" contains information on a host of aspects, including, for example:

- Physical/chemical parameters
- Environmental behaviour (decomposition behaviour, stability, bioaccumulation, biomagnification)
- Toxicology (such as acute, sub-acute, chronic and sub-chronic toxicity)
- Ecotoxicology (aquatic and terrestrial systems)
- Substance-specific specifications
- Industrial safety
- Background values for inorganic and organic substances in soils
- Analytical methods

The original source is stated for all data.

Figure 24: CD cover of the STARS database

Furthermore, the user interface was optimised and adapted to the new data contents. Also available is the XUMA-A^{MOR} program for analysis planning for the examination of historical military burdens, east German industries and historical pollutions from military uses [**A**nalysenplanung bei der Untersuchung **mi**litärischer Altlasten, **o**stdeutschen Branchen und **R**üstungsaltlasten] (refer to the 2000 Annual Report).

Figure 25: CD cover of the XUMA-A^{MOR} program

STARS and XUMA-A[MOR] are distributed on CD-ROM, the databases are updated and the programs are developed further by Stoller Ingenieurtechnik, Bärensteiner Straße 27-29, 01277 Dresden, Germany, telephone. +49 351/ 2 12 39 30, fax: +49 351/2 12 39 59, e-mail: SIGDresden@aol.com. The programs are distributed to public institutions at cost price. Users from business and industry can buy the individual programs or program packages at higher prices. *(II 5.2, II 5.3)*

Advisory services for central and eastern Europe

The Federal Ministry for the Environment has launched a consultancy assistance programme for central and eastern European countries which attaches great importance to education and training in the interest of sustainable development, i.e. lasting environmentally compatible development. This was also the purpose of UBA's consultancy work at Mendel University for Agriculture and Forestry in Brno, Czech Republic. "Waste management" is to be established there as a new course of studies. A Czech delegation, university professors and a representative of the Czech Republic's Ministry for the Environment attended relevant teaching and research institutions at German universities in Gießen, Kassel, Hamburg-Harburg and Rostock in order to gather experience for their work. They also visited companies and plants for the recycling and disposal of communal waste.

In November 2001, UBA initiated a German-Czech seminar on the latest developments in theoretical and practical waste management at Brno. In continuation of the consultancy assistance programme, two professors from Brno were subsequently given the opportunity to familiarise themselves with German waste analysis methods at the Karlsruhe-based research centre.

Within the scope of bilateral agreements and the consultancy assistance projects of the Federal Ministry for the Environment, UBA supported the Slovak Ministries for Soil Management and Environmental Protection in the preparation of a new Slovak soil protection act. In November 2001, a German-Slovak seminar on the Federal Soil Protection Act (BBodSchG) was held in Bratislava for a large circle of Slovak experts from administration and scientific institutions. A continuation of the bilateral exchange of experience is planned for the year 2002. *(II 5.1)*

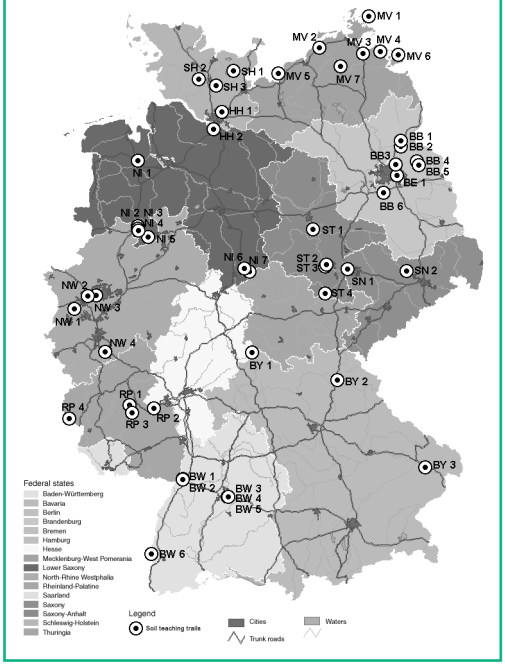
Travel guide "Zu den Böden Deutschlands" [To the soils of Germany]

The travel guide "Reiseführer – Zu den Böden Deutschlands. Böden sehen – Böden begreifen" [To the soils of Germany. Seeing soils – understanding soils] was published in May 2001. This brochure invites readers to visit 49 objects in 12 Federal states. Soil teaching trails, soil monuments and soil museums are presented in detail (figure 26). This guide has met with very strong demand: Two editions with 3,000 copies each were sold within a few weeks.

The travel guide currently presents 49 locations of soil teaching trails, museums and pedological collections. All the destinations described in the guide feature carefully presented subjects for those who are generally interested in the "soil" subject.

The descriptions start with access route information. The different soils and their special characteristics are described for each site in chapters titled "What is to be seen?" and "Soils and landscape". On site, further information on the respective soils, descriptions of the landscapes where the soils developed, as well as information on the many-sided aspects of soil pro-

Figure 26: Travel guide "Zu den Böden Deutschlands" [To the soils of Germany]



tection are offered for pedological excursions to the destinations presented in this guide.

The "Reiseführer – Zu den Böden Deutschlands" [Travel guide – to the soils of Germany] is available on the Internet at: www.umweltbundesamt.de as an HTML and PDF document. It is also available on CD-ROM from UBA's Central Services Unit (address on page 109). *(II 5.1, II 5.2)*

Soil awareness for multipliers

The Advisory Council on Soil Protection (WBB) at the Federal Ministry for the Environment is preparing a publication which – similar to the travel guide introduced above – marks an attempt to increase the general public's awareness of soils. This publication is designed for people (multipliers) who directly or indirectly have something to do with soils. The documentation will bundle ideas, contacts and references concerning soil-related and soil protection activities and improve the transfer of information.

Free copies of the documentation titled "Ohne Boden – bodenlos" [Without soil – without ground] are available from the WBB office, c/o UBA, Unit II 5.1 Übergreifende Angelegenheiten [General Soil Protection Issues] (address on page 109). *(II 5.1)*

Critical limits for heavy metals

UBA has prepared technical papers for an international work group on soil as an asset worthy of protection. The mapping programme of the *UN-ECE Convention on Long-range Transboundary Air Pollution* (UN-ECE: United Nations Economic Commission for Europe) has commissioned this work group to define **CRITICAL LIMITS** for contents or concentrations of lead, cadmium and mercury in soils and waters.

These definitions are based on risk assessment methods for heavy metals which are generally accepted in the EU and by the Organization for Economic Co-operation and Development (OECD). Databases available at UBA concerning the effects of these three metals on microorganisms, invertebrate soil organisms and plants were made available for joint evaluation. The work is expected to be concluded in autumn 2002. The following preliminary critical limits (future revision is conceivable) will already be used in the first European mapping studies in spring 2002 (in parentheses: ranges defined in order to allow for uncertainties):

Contents adsorbed in soils:
- Cadmium: 0.9 mg kg^{-1} (0.7 to 0.11 mg kg^{-1})
- Lead: 30 mg kg^{-1} (25 to 35 mg kg^{-1})

Concentrations in soil water:
- Cadmium: 0.8 µg l^{-1}, (0.6 to 1.0 µg l^{-1})
- Lead: 8 µg l^{-1} (6 to 10 µg l^{-1})

(II 5.1, II 1.2)

Critical limits: *Action-related characteristic values at which no harmful effects on structure and function of ecosystems are to be expected not even in the long term if such limits are adhered to.*

Gene products in soils

The research project on "Effects of gene products on the habitat function of soils" was concluded in January 2002. The Institute for Molecular Biology and Applied Ecology, Schmallenberg, (formerly Institute for Molecular Biology and Ecotoxicology) of Fraunhofer Gesellschaft was commissioned with this study.

The aim of the literature study was to identify methods with the highest level of standardisation possible in order to describe the effects of genetically modified plants on the habitat function for soil organisms. For this purpose, a comparative literature evaluation of techniques and analytical methods used in modern molecular biology and ecotoxicology was carried out, and an assessment was made with regard to the suitability of these techniques and methods for determining the effects on soil biology. The different "action molecules" which can constitute a risk potential in genetically modified plants had to be taken into consideration in this context.

The result was a range of methods which were standardised in certain central aspects and which might be suitable for identifying the effects of genetically modified plants on the habitat function of soils with a view to soil organisms.

The study titled "Wirkung von Genprodukten auf die Lebensraumfunktion von Böden" [Effects of gene products on the habitat function of soils] is available on loan from UBA's library (address on page 2).
(II 5.1)

Finance offers for contaminated sites and land recycling projects

As a result of a research project on *"Economic aspects of contaminated sites rehabilitation"*, a guideline is now available on financing for rehabilitation and land recycling projects. The company of Tauw GmbH, Berlin, which prepared this study compiled the major finance instruments offered by the Federal government, Federal-state governments, development agencies of the Federal states, foundations and other sources. Furthermore, products and services offered by banks and insurance companies which might be useful for the implementation of projects of this kind were also analysed.

The guide is designed to enable citizens, companies and organizations responsible for rehabilitation, as well as engineering firms and staff at environmental agencies to survey the finance instruments on offer and to develop the perfect solution for every single case.

The additional description of the support and subsidy situation in the UK, the Netherlands and the US enables readers to compare offers in these countries and provides additional suggestions which can also serve as a basis for the further development of support and subsidy instruments for the rehabilitation of contaminated sites and land recycling in Germany.

The report also summarises the products offered by insurance companies in order to cover any risks which can result from site contamination or from previous industrial uses of land. The reference volume is rounded off by the general terms and conditions of insurance policies covering the costs for the decontamination of soil as adopted by the Umbrella Organization of German Insurance Companies.

"Ökonomische Aspekte der Altlastensanierung – Leitfaden über Finanzierungsmöglichkeiten und -hilfen in der Altlastenbearbeitung und im Brachflächenrecycling" [Economic aspects of the rehabilitation of contaminated sites – a guide for financing possibilities and aids for the rehabilitation of contaminated sites and land recycling] (TEXTE 4/01) is available from Werbung + Vertrieb (address on page 109). The guide is also available on the Internet at: www.umweltbundesamt.de/altlast/web1/deutsch/3_1_1.htm. *(II 5.3)*

Soil analysis manual

The "Soil analysis manual" was amended by the 3rd to 5th supplement in 2001 representing the user-orientated systematics pursuant to the Bio-waste Ordinance. This means that the methods stipulated in Appendix 1 to the Federal Soil Protection and Contaminated-sites Ordinance are fully considered. Another central issue were more far-reaching methods for pedological descriptions in terms of soil microbiology, flora and fauna. The 6th to 8th supplements are planned for 2002, focusing on specifications and regulations for quality assurance, soil physics and methods for determining the contents of organotin compounds and explosive compounds.

An advisory editorial committee determines the technical contents to be included in the Soil analysis manual. This committee includes UBA representatives, as well as representatives of supreme Federal authorities and associations. The manual is published by an editorial team of reputable experts.

The "Handbuch der Bodenuntersuchung" [Soil analysis manual], edited by the Deutsches Institut für Normung, is published by Beuth Verlag, Berlin, Vienna, Zurich, and by Wiley-VCH Weinheim. The basic volume contains around 1,800 pages and costs 229.06 euro (basic volume.) It is available from bookstores (Beuth: ISBN 3-410-14590-7, Wiley-VCH: ISBN 3-527-19080-5). *(II 5.4)*

Soil layers penetrable by roots

One of the functions of UBA's laboratory for soil analyses is to check analytical methods for equivalence and the comparability of test results pursuant to the Federal Soil Protection and Contaminated-sites Ordinance. In this context, UBA and some Federal-state governments and associations concerned empirically determined the contents and availabilities of pollutants for the soil-to-plant and soil-to-percolation water paths in random samples of industrially produced soil materials consisting of compost from freshly cut plants and soil excavated in urban areas.

It was found that the heavy-metal contents of such soil materials are often above the prevention values for sandy soils, taking Articles 12 and 9 of the Federal Soil Protection and Contaminated-sites Ordinance into consideration in conjunction with Article 7 of the Federal Soil Protection Act. It was also examined whether – in the event that the prevention values

in the materials are exceeded – the eluate values (insignificance thresholds defined by Länderarbeitsgemeinschaft Wasser – LAWA – or trigger values for the soil-to-groundwater path pursuant to the Federal Soil Protection and Contaminated-sites Ordinance) are adhered to, so that it is thus guaranteed that no harmful soil changes can occur if such soil materials are used.

In 2002, UBA will continue monitoring the issues raised in this project, in particular, in order to foster the debate on the comparability of elution methods and to determine criteria for proposed processes in the case of elevated heavy-metal contents.

(II 5.4)

Department II 6:

Air

New air quality regulations

The European Union (EU) has introduced a new system of air quality regulations which is gradually being implemented in German law. The *Directive on Air Quality (Council Directive 96/62/EC on Ambient Air Quality Assessment and Management)* demanded the development of regulations for 13 air pollutants. Directives are today available for seven important substances: i.e. the

1. EC Daughter Directive (Council directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air)

2. EC Daughter Directive (Directive 2000/69/EC relating to limit values for benzene and carbon monoxide in ambient air)

Immission values: *"Immission values" is a general term that includes, amongst other things, immission limits and alarm thresholds. Immission limits are values which may no longer be exceeded after a defined relevant date in order to avoid, prevent or reduce harmful effects on the environment. Alarm thresholds are values at which a hazard to human health exists even in the case of short-term exposure.*

3. EC Daughter Directive (Directive 2002/3/EC relating to ozone in ambient air)

The nation-wide, area-related approach of these directives requires far-reaching amendments in German law. The *Ordinance on Immission Values for Pollutants in Air (22nd BImSchV)* from 1993 is being revised and amended to this effect. An amendment to the *Federal Immission Protection Act (BImschG)* which will create the necessary conditions for this is currently in preparation.

The central element of the new provisions is that the air quality is defined by **IMMISSION VALUES** for the entire territory of Germany. Under the new directive, the applicable limits must be adhered to starting 2005 or 2010, respectively, after a transitional period. This requires air quality to be constantly monitored and assessed. Where the future immission limits, including a defined tolerance margin, are currently still exceeded, plans and programmes must be developed in order to implement suitable measures that guarantee that the requirement of permanent compliance can be fulfilled as of the relevant dates.

Plans must also be developed and implemented if there is a risk that immission values will be exceeded after the relevant date. An important feature is information to the general public on air quality as well as the related plans and programmes. The immission value system is supplemented by alarm thresholds for certain pollutants. In the event that these alarm thresholds are exceeded as a result of exceptional situations or events, such as special climatic conditions, the public must be notified. Plans of action must be in place in order to enable measures to be taken at short notice in order to restore the air quality to non-hazardous levels as soon as possible. The monitoring of the success of these plans and programmes by the obligation to inform the public and the obligation to submit regular reports to the EU Commission will create the pressure necessary to ensure that the daughter directives are adhered to.

Together with the Federal Ministry for the Environment (BMU) and UBA, work groups of the Federal states are addressing issues of air quality assessment as well as the necessary air quality control and action plans in order to introduce the system on a nation-wide and equitable basis. The results of the work groups' studies were already discussed by the Regional Commission on Protection against Immissions

(LAI). The experience and results from this discussion contributed to the European debate. *(II 6.1).*

Model-based assessment for plant-related immission protection

The revision of the *Technical Instructions on Air Quality Control (TA Luft)* was accompanied by a revision of the calculation method used to determine additional exposure levels. The new method replaces the formerly used Gaussian model. The core of the new calculation method is now the Lagrange particle dispersion model which is based on guideline 3945, sheet 3, issued by the German Association of Engineers (VDI). The new approach features the following major properties:

- It is a tried-and-tested approach which is currently generally available.
- It is consistent with the core of the validity range of the Gaussian approach pursuant to the Technical Instructions on Air Quality Control in the 1986 version.
- Although meteorological time series are used, it is still possible to use meteorological statistics.
- Emissions can be treated in a time-dependent manner (batch/shift operation).
- The approach is basically suitable for any terrain configuration (plain and complex terrain) and for any obstacle configuration (flows around buildings).

The computer program, including manual, documentation and calculation examples can be downloaded from the Internet at: www.austal2000.de. (II 6.1)

Air quality management and dust exposure

The *Protocol to Abate Acidification, Eutrophication and Ground-level Ozone* of the UN Economic Commission for Europe (UN-ECE, *Multi-component Protocol)* and the *EU's NEC Directive (Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants)* are designed to achieve substantial reductions of the following pollutants, i.e.

- sulphur dioxide (SO_2),
- nitrogen oxides (NO_x),
- ammonium (NH_3) and
- volatile organic compounds (VOCs)

in Europe by the year 2010. To this effect, national emission ceilings are defined for these air pollutants for each UN-ECE and European Union (EU) member state. In order to ensure that the ceilings defined by the EC NEC directive will be adhered to in Germany, NH_3, SO_2, NO_x and VOC emissions must be reduced by another 12 % to 38 %, depending on the particular parameter concerned, against 2000 levels.

UBA has prepared scientific analyses in support of the development of these two sets of regulations. As a first stage of implementation, a list of actions must be developed in order to ensure adherence to the ceilings.

The revision process scheduled for 2004 will include the addition of ceilings for fine dust to the two sets of regulations. Scientific work to this effect is underway. This will initially concern an analytical model for fine dust within the scope of a RAINS (Regional Air Pollution and Information Simulation) model. The module is designed to simulate the sources of emissions, including technical measures for their abatement and the resultant costs, as well as their transport and accumulation in the environment. Thereafter, scenario calculations will be carried out in order to analyse proposals for an efficient, Europe-wide environmental policy. This work is scientifically supported and subsidized by UBA. *(II 6.1)*

The EU "Clean Air for Europe" programme

In May 2001, the Environment Directorate informed the EU Commission of its new "Clean Air for Europe" (CAFE) programme. The aim of this programme which is integrated into the EU's forthcoming 6th Environment Action Programme is to develop a long-term, integrated policy for protecting human health and the environment as a whole against the harmful effects of air pollution. The strategy will be revised and updated at regular intervals, with a five-year cycle being currently planned for this.

Further information is available on the Internet at europa.eu.int/comm/environment/air/cafe.htm.
(II 6.1)

"Air and Climatic Change" Topic Centre of the European Environment Agency

Since 2001, UBA has been a partner in the newly established European Topic Centre (ETC) "Air and Climatic Change" of the European Environment Agency

(EEA). The topic centre is managed by the Netherlands Environmental Agency (RIVM), Bilthoven. UBA manages the sub-group on "climatic change".

The ETC has worked on a large number of tasks and thereby supported the EU Commission mainly in tasks resulting from the international climate conferences in Bonn and Marrakech (refer to chapter 5).

One task of the 2001 work programme was the development of indicators for climate impacts. In co-operation with its partners, RIVM and the Potsdam Institute for Climate Impact Research (PIK), UBA has compiled a comprehensive list of climate impact indicators on the basis of questionnaires, references and interviews. This list was discussed and, in part, modified at an international meeting of experts in Copenhagen which was prepared by UBA. This year, the updated core set of indicators will be supplemented by the necessary information and, in 2003, will be published by EEA in a special report.

Further information about the expert meeting can be found on the Internet at: etc-acc.eionet.eu.int.

As another task of the 2001 programme of action, the ETC compared the emission projections for greenhouse gases for the year 2010 for the entire European Union from different sources. These projections for the EU which were developed on the basis of national greenhouse gas emission projections of the EU member states or, alternatively, from EU-wide studies show sometimes considerable differences with regard to certain greenhouse gases. The EU Commission has included this result in its progress report to the European Parliament within the scope of the EU greenhouse gas monitoring mechanism.

The study titled "Analysis and comparison of national and EU-wide projections of greenhouse gas emissions" will be published as an EEA topic report. Copies are available from: EEA, Kongens Nytorv 6, 1050 Copenhagen, Denmark. The report will also be published on the Internet at www.eea.eu.int. (II 6.2)

Data exchange and information for the public

The data exchange for air quality data in the European Union (EU) is subject to the *Council Decision of 27 January 1997 establishing a reciprocal exchange of information and data from networks and individual stations measuring ambient air pollution within the Member States (Decision 97/101/EC)*. The EU Commission had decided to set up a work group with representatives from the member states in order to prepare an update of this Council decision. UBA managed this work group. The draft submitted emphasizes that the member states are responsible for assuring the quality of data. Furthermore, the member states can decide whether they prefer to submit basic data only to the EU or whether they will also report statistical characteristics which are calculated in addition. Moreover, the measuring network and measuring station information – the disclosure of which is mandatory on the one hand and the information that can be submitted on a voluntary basis on the other – are clearly defined. The *Commission Decision on the amendment of the Annexes to Council Decision 97/101/EC establishing a reciprocal exchange of information and data from networks and individual stations measuring ambient air pollution within the Member States (Decision 2001/752/EC)* which implements this draft was published on 17 October 2001.

The work group is currently preparing a guideline with many examples explaining all the provisions of the Council decision. Once completed, this guideline will be available in all the official EU languages on the EU Commission's website at: europa.eu.int.
(II 6.2)

Air quality data on the Internet

Pursuant to the provisions of the above-mentioned *EC Daughter Directives*, citizens have been regularly informed about current air pollution levels since 19 July 2001. UBA's Internet offer was completely revised in this context. Apart from information that was already available before concerning measured and forecast ozone concentrations, the pollutant maps pursuant to the 1st Daughter Directive have been updated several times a day since 5 June 2001. The time scale and geographic resolution of these maps give users a comprehensive picture of the air pollution situation, together with the limit-value information that is additionally provided. The pertinent tables show all the values of the past 14 days (sorted according to pollutant, Federal state and station).

The air quality data is available on the Internet at: www.umweltbundesamt.de key word: "Aktuelle Immissionsdaten aus den Messnetzen der Bundesländ-

der und des UBA" [Latest immission data from the measuring networks of the Federal states and UBA]. *(II 6.2)*

New emission reporting requirements

The *UN Framework Convention on Climate Change, UNFCCC, law of 13 September 1993)* and the *Kyoto Protocol on the Reduction of Emissions of Greenhouse Gases* defined for the first time ever flexible economic instruments as ways in which to reduce emissions, i.e. Joint Implementation (JI), Clean Development Mechanism (CDM) and emission trading.

The monetarisation of emission data – each tonne of carbon dioxide (CO_2) emissions will in future have a price that is determined on the market – will increase the requirements for the precision of emission calculations considerably. The data which the member states are obliged to report to the UNFCCC secretariat are subjected to a very demanding, international examination process (result check). Furthermore, the Kyoto Protocol also demands that the expertise available in the different countries be involved in the process of determining emissions. The interaction of all public agencies and institutions which can contribute towards improving the quality of emission data must be organized in a national system (figure 27). The functioning of such a system is a precondition for the approval of the use of the flexible economic instruments, and this is the specific importance of this task.

The national system is designed to ensure compliance with the following requirements for emission inventories:

- Transparency (calculations and results must be capable of being verified by third parties)
- Consistency (methodological comparability of the time series in the countries)
- Comparability (international comparison of the countries' data)
- Completeness (proof of inclusion of all relevant sources and sinks)
- Accuracy (quality assurance and management for the calculation process).

The Federal Ministry for the Environment (BMU) has decided that UBA is to co-ordinate all the activities for the establishment and future operation of the national system. First experience with the operation of the system must be reported starting in 2004. Proof of complete implementation and functioning must be furnished to the UNFCCC Secretariat by 31 December 2006.

As of 2002, the "Emission inventories" working circle of the Federal government's inter-ministry work group on CO_2 emission reduction will be involved in the process, and UBA will commission a research project in order to develop the national system further.

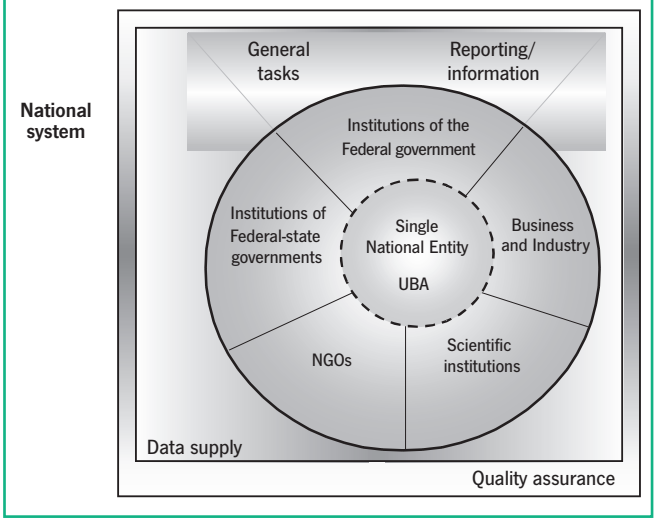
Further information can be found on the Internet at: www.unfccc.de. *(II 6.3)*

European test procedure for fine dust particles

The hazards which fine dust poses to health have become increasingly apparent in recent years (refer to the 1999, 2000 annual reports). Fine dust exposure was so far determined on the basis of particles with a grain size of less than 10 micrometres (particulate matter 10, PM_{10}).

The 1st EC daughter directive (see above, page 140) obliges the EU member states to carry out measurements of particles with a diameter of 2.5 µm ($PM_{2.5}$) at stations which are representative for fine-dust exposure in the respective member state in addition to PM_{10} measurements. The problem is, however, that unlike for PM_{10}, a European reference measuring method for $PM_{2.5}$ is not yet available. This is why comparative measurements of different manual gravimet-

Figure 27: National emission reporting system



ric and automatic $PM_{2.5}$ measuring methods have been carried out since autumn 1999 on behalf of the EU Commission at eight locations in southern, central and northern Europe in order to identify a suitable $PM_{2.5}$ reference method. This will be implemented in the form of a standard to be issued by the European Committee for Standardization (CEN). Important parts of these comparative tests are function testing of the equipment used, quality assurance and data evaluation as well as co-ordination of the measuring programme. UBA is carrying out these tasks parallel to local measurements. The studies will be completed in spring 2003. *(II 6.4)*

Measuring fine-dust particles of varying grain sizes

Measuring series over many years show that the matter contained in airborne particles accumulate in different particle sizes, depending on their physical and chemical properties.

The analyses showed that organic matter (including soot) and easily volatile inorganic compounds are bound chiefly to particles with a diameter of less than 1 micrometre (µm). This particle-size fraction of airborne dust which penetrates deep into the lungs during breathing is detected at the lower stage of a three-stage impactor.

The particle-size fraction of airborne dust with a diameter ranging between 1 and 2.5 µm is detected by the middle stage of the impactor. Inorganic salts and non-easily volatilised acids account for most of this fraction.

The particle size fraction with a diameter ranging from 2.5 to 10 µm is detected by the input stage of the impactor. This fraction of airborne particles contains mostly metal oxides and minerals circulating in air. Most of this fraction is retained in the nose and throat.

The impactor samples so far analysed show that one third of the airborne particles collected accumulates at each stage on average. *(II 6.5)*

Integrated monitoring in the Bavarian Forest

Since 1990, Germany has taken part in the **I**nternational **C**ooperative **P**rogramme on **I**ntegrated **M**onitoring on Air Pollution Effects on Ecosystems (ICP IM). This standardised, international monitoring programme is based on the *UN-ECE Convention on Long Range Transboundary Air Pollution* of 13 November 1979.

The hydrological basin of the "Forellenbach" brook in the Bavarian Forest National Park is the long-term monitoring area where comprehensive environmental monitoring is performed on rain, soil, surface water, groundwater and biotic samples. The aim is to study the influence of long-range pollution on ecosystems. The measuring data is used to identify important evaluation parameters (critical loads, critical levels, refer to page 139) and to develop and verify forecasting models as a basis for political decisions.

The air quality control measures implemented in Germany and Europe have already led to a continuous reduction of pollution with sulphur-containing matter (immission and accumulation values) both in forest soils and in waters flowing off these soils.

The curve of the concentration of inorganic nitrogen compounds (ammonium, NH_4^+, nitrate, NO_3^-) in rain also declined over the past ten years, however, to a lesser extent than in the case of sulphur compounds. Reduction rates varied, depending on the specific nitrogen compound concerned and time. *(II 6.5)*

Atmospheric monitoring: education and training

Within the scope of the World Meteorological Organization's (WMO) Global Atmosphere Watch (GAW) programme, UBA is running the Quality Assurance/Scientific Advisory Centre (QA/SAC) for Europe and Africa. Training of staff from other GAW stations is one major aspect of this work.

The Bavarian Ministry for the Environment is supporting UBA in this effort over an initial term of three years for the establishment and operation of a training centre at UBA's GAW station in the Schneefernerhaus on the Zugspitze peak. Training is offered after consultation with and participation of experts from the German Meteorological Service (Deutscher Wetterdienst) (DWD, Hohenpeißenberg observatory), the Fraunhofer Institute for Atmospheric Environmental Research and UBA (QA/SAC, Langen branch and GAW station). The Leipzig-based Institut für Tro-

posphärenforschung will become involved with regard to aerosols. *(II 6.5, II 6.6)*

30th anniversary of the Federal Environmental Agency's pilot station

On 5 November 2001, UBA's pilot station in Langen near Frankfurt am Main celebrated its 30th anniversary. Three decades ago, a work group at the institute for meteorology and geophysics at Frankfurt am Main University headed by Prof. Dr. Hans-Walter Georgii started measuring air pollutants. In 1971, this work group was commissioned to establish an automatic station for measuring air pollution in a densely populated area. This marked the birth of the "air quality management pilot station". In 1974, it became part of the newly established UBA.

Today, the pilot station works in a modern laboratory building. The station's tasks include air sample analyses and the development of measuring methods. Within the scope of quality assurance, the pilot station serves as a national reference laboratory for the European Union. Over the past three decades, the pilot station and UBA's measuring network has supplied a host of information on air pollution (relevant substances, their quantities, origin, transport and accumulation, as well as the measuring systems and methods needed for these purposes). More recent, additional tasks of the pilot station include integrated measurement and evaluation of environmental burdens caused by air pollution. These tasks also represent a contribution towards the integrated monitoring programme of the UN Economic Commission for Europe (UN-ECE). *(II 6.5)*

Polybromide diphenyl ether in the environment

Polybromide diphenylethers (PBDEs) serve as flame retardant additives for plastic materials. These substances can be contained in appliance housings, electronic components and textile back coatings. Since these substances accumulate in the food chain, their concentration in breast milk in Sweden increased 60-fold as a long-term study from 1972 to 1997 suggests. Analyses of blood samples in the German Environmental Specimen Bank (UPB) taken over several years show a 1.4-fold increase of these compounds between 1985 and 1999. A recent Swedish successor study shows a 68 % decline of the maximum value between 1997 and 2000 as a result of a voluntary restriction of the use of these substances in many countries.

Whether or not PBDE is a persistent organic pollutant (POPs, refer to chapter 12) has not yet been ultimately clarified scientifically. The "POP laboratory" in the UBA building in Langen has started a systematic study of the occurrence and accumulation of PBDE in the environment. House dust was studied as the first sample matrix. Samples were extracted, the extracts were purified and analysed by gas-chromatographic mass spectrometry.

PBDE was found in each of the samples analysed. This means that these substances enter the environment not just at the end of a product's life cycle, but already during its use as a result of abrasion or release from the polymer matrix. They can then enter the food chain and hence pose a hazard to human health via the path: waste water – sewage sludge – agricultural use of sewage sludge. This will be the subject of further examination. These studies are a contribution towards the ongoing EU risk assessment for PBDE. *(II 6.5)*

German "EMEP heavy-metal superstation" established

Following the signing of the *Protocol on the 1979 Convention on Long Range Transboundary Air Pollution* of the United Nations Economic Commission for Europe (UN-ECE) in Århus (1998, Århus Protocol), approved by the EU in its Decision 2001/379/EC of 4 April 2001, heavy metals were added to UN-ECE's Cooperative Programme for the Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP). The heavy metals cadmium, lead and mercury are given priority. The elements arsenic, nickel, chromium, copper and zinc have to be studied subsequently. Reliable heavy-metal measurements are necessary in order to amend and validate the modelling of the long-range, transboundary transport of heavy metals. To this effect, EMEP primarily relies on a "core network" of around ten so-called "heavy-metal superstations" at representative locations throughout Europe.

Heavy-metal superstations are subject to special requirements concerning site criteria and quality assurance. The core network of heavy-metal superstations is supplemented by optional measurements at other EMEP measuring stations. UBA's Waldhof measuring

station in the Lüneburg heathlands was developed to the German EMEP heavy-metal superstation in 2001.

The measuring programme and measuring methods are described in the EMEP manual on the Internet at: www.nilu.no/projects/ccc/manual/index.html.

(II 6.6)

Determination of dry ammonia immissions into soils

Wet and dry deposition must be determined as a condition for assessing the violations of critical-load levels (refer to chapter 1) of substances with an acidification and eutrophication action in ecosystems. Operational measuring networks so far enable measurements of wet and total deposition only. This is why a research project was set up in order to test a simple measuring method for determining dry ammonium (NH_3) deposition suitable for use at the stations of UBA's measuring network with reasonable effort and cost. For this purpose, the NH_3 altitude concentration profile (0.5 m to 4.5 m above ground) is to be determined using moving passive collectors fitted on weathercocks. The NH_3 flows and NH_3 immissions due to deposition and re-emission are then to be determined, taking micrometeorological conditions (wind velocity and temperature at the lower and upper altitude levels) into consideration. The concentrations determined using the passive collectors show a relatively large scatter, so that it was not possible to statistically verify the generally rather diffuse NH_3 altitude concentration profile. However, the method using passive collectors on weathercocks was found to be a suitable way for determining long-term NH_3 concentrations in an operational measuring network.

The analyses were performed at the Melpitz measuring site of the institute carrying out this study, i.e. the Leipzig-based Institut für Troposphärenforschung.

(II 6.6)

Carbonyl measurements of the UBA measuring network

Carbonyls (hydrocarbons containing oxygen) as well as hydrocarbons themselves are subject to the monitoring tasks pursuant to the *VOC Protocol (Protocol of 19 November 1991 concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes)* of the Geneva Convention on Long-range Transboundary Air Pollution. Samples are currently being taken and measurements performed in four countries within the scope of EMEP (see page 146). Initially, the countries involved took samples only, whilst the analyses were performed centrally at the EMEP chemical co-ordination centre at the Norwegian Institute for Air Research (NILU). Good conformity was found during two years of parallel measurements by UBA. The commencement of operational measurements by UBA was agreed to with NILU. Samples will be taken over eight hours a day from 8.00 a.m. to 4.00 p.m. from Monday to Thursday every week. *(II 6.6)*

Re-organization of the rain measuring network

UBA has re-organized its rain measuring network. This was necessary because the geographical distribution of the measuring stations was very inhomogeneous after German reunification. Furthermore, the pollutant exposure of rain clearly declined in recent years, which is leading to generally more homogenous geographical concentration patterns. The number of stations was reduced from 30 to 20 without any risk of reducing information content. Eleven stations were closed. UBA set up an additional station in the Lower Rhine / western Münsterland region in order to achieve nation-wide coverage. The annual report by the measuring network includes a detailed description of the methods and of the new structure of the measuring network.

Free copies of the annual report of the measuring network are available from the Central Answering Service (see box on page 109). *(II 6.6)*

Visitors to the Schauinsland measuring station

The Schauinsland station of UBA's measuring network in the Black Forest saw a new visitor record. During a hiking week organized by the Südwestrundfunk (SWR) radio and TV station, 487 hikers visited the station on 16 August 2001. The station manager reported on the tasks and objectives of the station's measurement and sampling programmes. Climate protection and greenhouse gas measuring aspects were focal aspects of this discourse. *(II 6.6)*

Division III: Environmentally compatible technologies – procedures and products

Department III 1:

Technology and product evaluation

Contribution made by biotechnological methods to risk prevention

With a view to industrial sustainability and environmentally compatible technologies, **BIOTECHNOLOGY** is considered to have enormous potential. In order to analyse the potential for reducing risks which biotechnology has to offer in the chemical industry, the Federal Environmental Agency (UBA) has commissioned the environmental institute, Dr. Rhein, in Sarstedt, to draft a report in co-operation with TEXYS GmbH, in Hannover.

Chemical processes often take place at high temperatures and under high pressure, whilst bio-technological processes are operated at mild temperatures and under normal pressure. This means that a significant increase in working and plant safety can be achieved.

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

The report identified 30 chemical processes where the use of biotechnological methods would lead to a clear reduction in the process risk. Of the four production processes that were examined in detail (acrylamide, n-butanol, L-phenylalanine and propylene oxide), L-phenylalanine, in particular, was found to have a significant potential for risk reduction. This is true both with a view to the process parameters as well as to the elimination of risk-relevant chemicals – such as carbon monoxide, ammonia or hydrogen in the biotechnological production process.

The report titled "Substitution chemischer Verfahrenstechniken durch bio-/gentechnische Verfahren zur Risikovorsorge" [Substituting chemical production methods with biotechnological/genetic engineering methods in order to prevent risks] will be published in the TEXTE series and will be available from Werbung + Vertrieb (address below). *(III 1.1)*

Biotechnology: *The use of biological organisms, systems and processes to produce goods and services.*

Investment of a demonstrative nature

UBA is supporting the "Programm zur Förderung von Investitionen mit Demonstrationen zur Verminderung von Umweltbelastungen" [Programme to promote demonstration investment in order to avoid environmental burdens] by the Federal Ministry for the Environment (BMU) by assessing project applications on a technical level.

This programme (first initiated in 1979 as a subsidy programme for "Investitionen auf dem Gebiet der Luftreinhaltung bei Altanlagen" [Investment in the field of air quality for existing plants] was amended in the 1980s in order to cover all environmental fields. General support is now available for projects of a demonstrative nature that are designed to avoid envi-

ronmental burdens and used on a large scale for the first time in Germany. Particular preference is given to advanced process and production techniques or combined processes, as well as to methods for the production and application of environmentally compatible products.

Within the scope of this subsidy programme, more than 700 projects have been implemented since 1979 with a total subsidy sum of around 920.3 million euro (DM 1.8 billion).

Around 19.5 million euro (around DM 38.2 million) was earmarked in 2001 for this programme.

During this period, UBA received a total of 58 project sketches for technical examination. These applications were related to the following environmental fields:

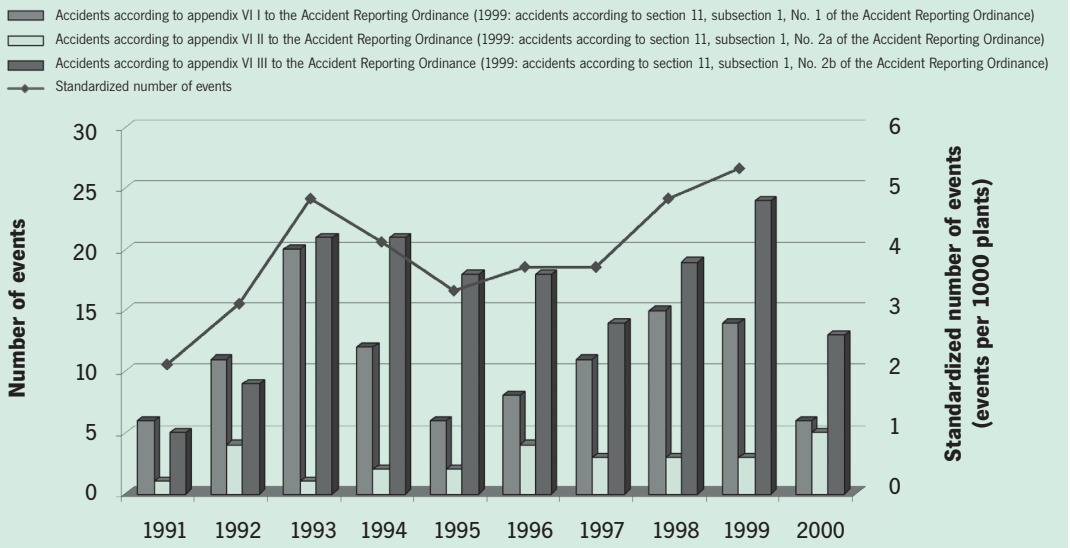
Waste:	26
Energy:	20
Water:	7
Air:	5
Noise:	0

There is a clear trend in the project sketches towards media-integrated, environmentally compatible solutions, so that their assignment to a single environmental field is being increasingly carried out on the basis of their main focus. 23 of the project sketches received failed to meet with the conditions of the valid subsidy guideline and had to be rejected. Table 14 lists all the projects that were approved in 2001.

Table 14: Subsiding investment: Projects approved in 2001

Recipient	*Subject*
Shieer Agrar Biorecycling GmbH, ABR Agrar Bio-Recycling GmbH	*Methanisation and electricity generation from biomass in Wietzendorf*
Ruwel-Werke Spezialfabrik für Leiterplatten GmbH	*Treatment plant for complex-containing waste water*
Albers Logistik GmbH	*Combined bulk-goods and liquid transport vehicle*
Albrecht Beck	*Photo-voltaic demonstration plant Dimbach*
GASAG Berliner Gaswerke AG	*TUT – Thousand Environmental Taxis in Berlin*
STEAG Energie-Contracting GmbH (SEC)	*Cogeneration plant with used wood as fuel in Dresden Heidenau*
CLAAS Selbstfahrende Erntemaschinen GmbH, Harsewinkel	*Construction of a new painting line*
Kraftwärmeanlagen GmbH	*Ecological power supply concept Mutterstadt*
Easy Health Lebensmitteltechnologie AG	*Production line for low-cholesterol egg products*
VARTA Gerätebatterien GmbH	*Environment-friendly production of rechargeable, long-life lithium polymer batteries with solid electrolytes and extruded electrodes*
Membrana GmbH	*Removal of ammonium from production exhaust air*
Carl Robert Eckelmann Transport und Logistik GmbH	*Port feeder barge*

Figure 28: Reports according to the Accident Reporting Ordinance



In order to provide greater access to both applicants and those interested in the investment programme and to facilitate project management after an application has been approved, a dedicated co-ordination and contact office was set up at UBA, Project-Management-Invest. This office can be reached by calling: +49 30/89 03-3067 (Karin Fischer) and +49 30/8903-3335 (Carola Diewitz).

(III 1.1/PMI).

Hazardous incidents: Incidents that must be reported in Germany

The revised *Hazardous Incident Reporting Ordinance (StörfallV)* also provides new principles for organizing the exchange of experience concerning the status of safety and protection. For example, the range of hazardous incidents that must be reported has been expanded considerably. Furthermore, any findings from hazardous incidents (refer to chapter 11) and other experience gained during operations must be systematically recorded and evaluated with the scope of the safety management system. In order to support the exchange of information between plants, an active information management system is being developed at UBA on the basis of the data supplied by the Agency's ZEMA Hazardous Incident Notification Office. The aim is to provide specific safety information using interactive Internet techniques: Only the information actually required by the user is to be "filtered out" of the huge flood of information.

24 incidents and disruptions in normal operations took place in 2000 in plants according to the Hazardous Incident Reporting Ordinance. Two people died and 120 people were injured (Figure 28). The 6 incidents and 18 disruptions in normal operations were primarily reported by chemical plants. 66 % of plants must observe the extended obligations of the Hazardous Incident Reporting Ordinance and must hence submit a safety report. Around 46 % of the events reported occurred while the plants were operating under normal conditions. The causes were mainly technical defects in equipment and fittings. The most frequent consequence (in 51 % of cases) was a release of hazardous substances, with fire or explosion occurring less frequently.

The ZEMA yearly reports are available free of charge from UBA's Central Services Unit (address on page 145). This information is also available on UBA's website at: www.umweltbundesamt.de.

An assessment of the results based on the evaluations by the Federal Statistic Office on accidents with water-endangering substances on behalf of BMU's Council on the Storage and Transport of Water-endangering substances (LTwS) is available on the LTwS homepage at: www.ltws.de. *(III 1.2)*

Guideline for environmentally compatible product design

The ISO TR 14062 technical report titled "Environmental Management – Integrating environmental aspects into product design and development" was completed at the end of 2001. This will form an important part of the ISO 14000 "standards family". The document will be finally adopted in 2002 in the relevant committees of the International Organization for Standardization (ISO). Serving as a guideline, this document addresses all those who are either directly or indirectly involved in the development of products. It is designed to identify approaches for environmental protection in product design and in product development.

At the German end, this work was carried in work committee 1 "Umweltaspekte in der Produktentwicklung" [Environmental aspects in product development] at the Normenausschuss Grundlagen des Umweltschutzes (NAGUS AA 1) [Standards committee on fundamentals of environmental protection] and with the participation of UBA. NAGUS AA 1 is currently translating the document into German.

The German and English versions are to be published together as a DIN technical report. (III 1.3)

Support in environmental issues for the European standardization committees

At the end of 2001, the pilot phase of the "Environmental Help Desk for Standardization" (EHD) at the European Committee for Standardization was completed which was financed as a demonstration project with funds from the Environmental Research Plan (UFOPLAN). The report on the pilot phase was published at the end of 2001.

Based on the example of the co-ordination office for environmental protection at the Deutsches Institut für Normung (DIN-KU), one to two employees have been assisting the standardization committees in CEN since September 1999 when it comes to addressing environmental aspects in draft standards. The EHD offers advice, establishes contacts with experts from all areas of environmental protection, comments on draft standards, supplies the committees with checklists against which they can check their work, and supports them when it comes to drafting sector-specific guidelines for addressing environmental issues in standardization.

A host of topics are included. This primarily involves not just product standards, but also includes standards for measuring and testing methods, production processes or standards concerning technical terminology. For example, the EHD was able to exert its influence on the draft standards for oil heating and for waste containers.

In August 2001, the EHD moved from Berlin, where it was formerly hosted by DIN, to CEN in Brussels. This facility is to be jointly financed in future by the EU Commission, CEN and the EU member states.

More information on the EHD as well as a summary of the report are available on the Internet at: www.cenorm.be/sectors/ehd.htm . The complete report is available free of charge from: CEN/Environmental Help Desk, Rue des Stassart 36, B-1050 Brussels, Belgium, telephone: +32-2/55 00-833, telefax: +32-2/55 00-819. (III 1.3)

Environmentally friendly procurement

More environmental protection by purchasing environmentally compatible goods and services – that is the aim jointly pursued by the BMU, UBA and Bundesverband für Umweltberatung (bfub) [Federal Association for Environmental Consulting]. Within the scope of an international convention "Think global – buy green" that was held in Heidelberg, Germany, from 22 to 23 October 2001, the 80 and more participants from public institutes, institutions and business were given an overview of the range of sustainable public procurement in Germany and abroad, of the legal foundation in European and German law and of the political importance of environmentally friendly procurement on Federal-government, Federal-state and municipal levels.

Environmentally friendly public procurement is being carried out in a determined and dedicated manner in many areas. In future, this will not just cover goods, but will also extend to services and hence to all areas of procurement and ordering. UBA considers training and further education for those employed in procurement as an important precondition, so that the pioneering role of some authorities can be used and developed in order to motivate others. This applies to various areas, for example, to the use of regenerative energy or products from ecological farming.

Detailed information can be found on the Internet at: www.beschaffung-info.de . (III 1.3)

Dynamic developments with the "Blue Angel" eco-label

The "Blue Angel" eco-label witnessed dynamic development once again in 2001. This is due to the new license agreements entered into and existing agreements terminated each year. 779 German and foreign suppliers are currently using the "Blue Angel" for more than 3,600 environmentally friendly goods and services. This development is hence in line with the long-term trend (Figure 29).

Although the number of new eco-label products, i.e. 688, rose significantly compared to the previous year, the total number of products bearing the "Blue Angel" eco-label at the end of 2001 failed to reach the previous year's level. What is pleasing is that there is still considerable interest in the eco-label among manufacturers and retailers – a fact that is demonstrated by the number of new license agreements entered into for the eco-label for low-emission furniture according to RAL-UZ 38 or for low-emission wall paints according to RAL-UZ 102. *(III 1.3)*

New Internet look for the "Blue Angel"

In 2001, UBA and Deutsches Institut für Gütesicherung (RAL) placed a thoroughly revised homepage on the Internet with an enhanced information platform. This is now clearer, offers more information and is interactive. This new homepage is part of a new marketing concept to boost the oldest and globally most successful eco-label. (Figure 30, page 150)

The newly designed pages can still be reached at the familiar Internet address: www.blauer-engel.de.

(III 1.3)

Eco-label for services

Services are accounting for an ever-greater share in gross domestic product (GDP). Furthermore, they can also contribute towards sustainable, i.e. lasting, environmentally compatible consumption. This prompted the decision to commission a research project to be carried out by Institut für Zukunftsstudien und Technologiebewertung (IZT) in Berlin, which analysed a total of 30 services from the fields of "leisure-orientated/tourism services" as well as "product-orientated services" with a view to their market potential, consumer relevance and environmental aspects. The following were selected for closer examination:

- Leisure-orientated swimming pools
- Upgrading of PCs
- Energy contracting

The results of the sub-studies were each discussed in specialist talks and general findings were derived on the basis of the experience gained. Based on this, it becomes clear that in contrast to awarding

Figure 29: Number of products bearing the eco-label

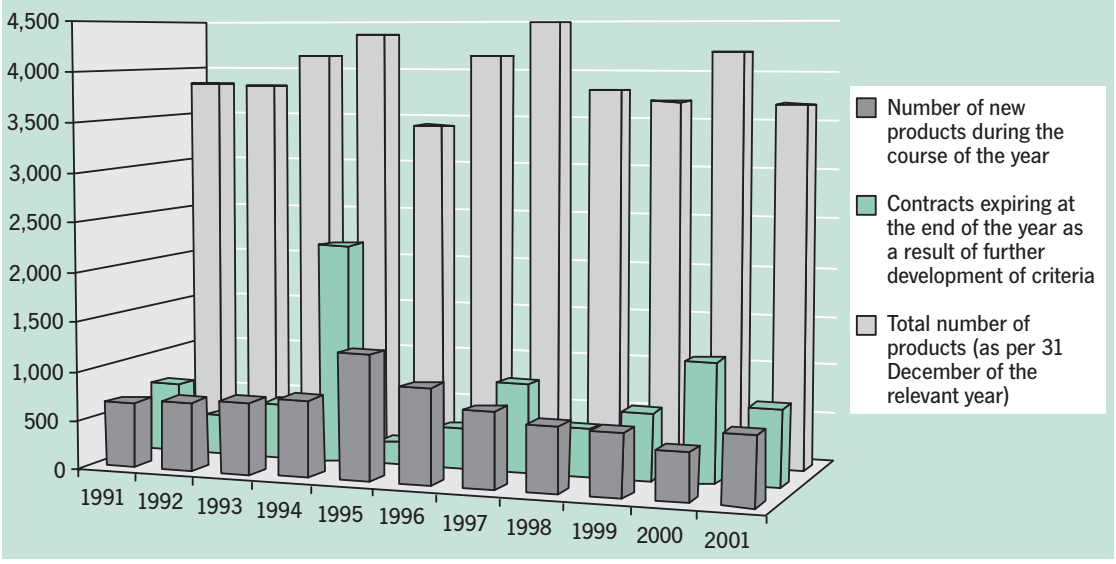


Figure 30: The new "Blue Angel" homepage

the eco-label for goods, the following peculiarities have to be considered when awarding the eco-label for services:

- It is difficult to compare services due to the individual services on offer and the different quality of the work.
- Evaluation is usually only possible in retrospect.

The study "Erarbeitung von fachlichen Grundlagen zu Umweltzeichen für verbrauchernahe Dienstleistungen" [Drafting technical fundamentals for the eco-label for consumer-near services] (TEXTE 75/01) is available in German and English from Werbung + Vertrieb (address on page 145). *(III 1.3)*

Eco-label for wallpaper

In 2001, the requirements for wallpaper and woodchip wallpaper (RAL-UZ 35a) and for wallpaper with other materials (RAL-UZ 35b) were harmonized with the stricter requirements that were adopted one year before for paper products – such as recycling paper (RAL-UZ 14), hygiene paper (RAL-UZ 5), recycling cardboard (RAL-UZ 56) as well as print and press paper (RAL-UZ 72). The share of lower and medium-grade used paper collected among consumers as required for the eco-label in the material to be used was increased and a general abandoning of complex formers that are slow to decompose and brighteners in the manufacturing process was made a precondition for awarding the eco-label. Furthermore, the maximum content permissible for formaldehyde emissions from wallpapers was reduced further. Traces of heavy metals may now only be found as a fraction of amount that was permitted up to now under a DIN standard for a child's toy. If fresh fibres are used to produce wallpaper, these must be from sustainably managed, certified forests. These new criteria will be in force starting in 2003. *(III 1.3)*

Eco-label for computers

The latest eco-label awarding principles for computers (PCs, RAL-UZ 78 and portable computers RAL-UZ 93) are placing greater requirements on the energy-saving function and low-noise operation of the de-

vices. Flat screens have been included in the scope of validity of the eco-label for workplace computers. Compliance with the requirements for recycling-enabled design and the avoidance of certain problem substances – such as halogenated flame-retardant agents – still serve as a precondition for awarding the eco-label. The new logo in the label that will be used starting in 2003 will read: "Umweltzeichen – weil energiesparend und recyclinggerecht" [Eco-label – because energy-saving and recyclable]. *(III 1.3)*

Eco-label for heating systems and heating recirculation pumps

Late 2001, the requirements of the eco-label on small furnace installations were revised and the changes were adopted by the eco-label jury. The new requirements have been in force since 1 January 2003.

Up to now, the "Blue Angel" eco-label for burners and boilers focused exclusively on reducing pollutant emissions and the degree of fuel utilization. In future, both the electrical power consumption (the amount of electricity which a device consumes) in "standby mode" and "normal mode" and – in the case of oil devices – also electrical consumption during a "cold start" will serve as a criterion for receiving the "Blue Angel". "Resistance at the heating-water end" was also defined as a further criterion, so that the pump current required to operate the heating equipment is indirectly restricted. Tables 15 and 16 show the present and the new requirements.

In addition to the existing eco-label awarding principles in the burner/boiler area, a new awarding principle has been drafted for automatic heating recirculation pumps. Compared to conventional heating pumps, these pumps, offering the same performance, save at least 25 % electricity. The eco-label has been valid since early 2002. *(III 1.3)*

Fluorinated refrigerants in car air-conditioning systems

Around one third of all cars registered in Germany are fitted with air conditioning. In the case of first-time registrations, this feature is already fitted in 80 to 97 % of cars – depending on the make. Since the ban on ozone-damaging substances, tetrafluoroethane (R 134a), a partially fluorinated hydrocarbon, is now used as the refrigerant; R 134a has a 1,600 times greater impact on climate than carbon dioxide (CO_2).

Table 15: "Blue Angel" eco-label requirements on low-emission and energy-saving oil heating systems

	RAL-UZ 9	RAL-UZ 46
Product	***Vaporising oil burner***	***Oil burner/boiler combinations***
Power range (kW)	*≤ 120*	*≤ 70*
Nominal degree of utilisation (%)	*n/a*	*≥ 90–91*
Carbon monoxdide (mg/kWh)	*≤ 60*	*≤ 60*
Nitrogen oxides (mg/kWh)	*≤ 120*	*≤ 110*
Hydrocarbons	*≤ 15*	*≤ 15*
Soot number	*≤ 0.5*	*≤ 0.5*
The following requirements will be effective as of January 2003		
Electrical power consumption in standby mode (W)	*n/a*	*≤ 8*
Average electrical power consumption during normal operation (W)	*≤ 250*	*≤ 220*
Electrical energy consumption during cold start (Wh)	*≤ 25*	*≤ 25*
Resistance at the heating-water end at a temperature difference of 10 Kelvin (mbar)	*n/a*	*≤ 800*

Table 16: "Blue Angel" eco-label requirements on low-emission and energy-saving gas heating systems

	RAL-UZ 39	*RAL-UZ 40*	*RAL-UZ 41*	*RAL-UZ 61*	*RAL-UZ 80*
Product	***Special gas heating boilers***	***Combined gas and recirculation-water heatings***	***Gas unit with super-charger burner***	***Gas boilers according to the gross calorific value principle***	***Gas burners with supercharger***
Power range (kW)	*≤ 70*	*≤ 30*	*≤ 70*	*≤ 70*	*≤ 120*
Nominal degree of utilisation (%)[1]	*≥ 90–91*	*≥ 89.5–90*	*≥ 90–91*	*≥ 103–104*[2] *≥ 100–101*[3]	*n/a*
Carbon monoxdide (mg/kWh)	*≤ 60*	*≤ 60*	*≤ 60*	*≤ 50*	*≤ 60*
Nitrogen oxides (mg/kWh)	*≤ 70*	*≤ 60*	*≤ 70*	*≤ 60*	*≤ 70*
The following requirements will be effective as of January 2003					
Electrical power consumption in standby mode (W)	*≤ 8*	*≤ 8*	*≤ 8*	*≤ 15*	*n/a*
Average electrical power consumption during normal operation (W)	*≤ 15*	*≤ 80*	*≤ 200*	*With supercharged burner ≤ 200 With ancillary supercharger: ≤ 80*	*≤ 200*
Resistance at the heating-water end at a temperature difference of 10 Kelvin (mbar)	*≤ 800*	*≤ 800*	*≤ 800*	*≤ 800*	*n/a*

1) The nominal degree of utilisation indicates the percentage of the primary energy input which us converted to usable heat under defined test conditions. In the case of the gross calorific value approach, the calculated nominal degree of utilisation may even exceed 100 percent because heat is "recovered" from the exhaust gas.
2) With a flow/return temperature of 40/30°C
3) With a flow/return temperature of 75/60°C

Partially fluorinated hydrocarbons, which due to their impact on climate were included in the *Kyoto Protocol* of the *Framework Convention on Climate Change* (refer to chapter 5), are used in many different ways, however, their most important form of application is as a refrigerant. In the case of R 134a, air conditioning systems in cars is the most important area of application in Germany.

In order to be able to assess both the present and future importance of the use of R 134a as a refrigerant for air conditioning systems in cars in terms of emissions of fluorinated climate gases, the environmental research office of Öko-Recherche in Frankfurt/Main has calculated on behalf of UBA the average emission of partially fluorinated hydrocarbons per air conditioning system per car.

The study came to the result that each vehicle air conditioning system emits an average of around 8.2% of the refrigerant per year into the atmosphere. In addition to this, further disposal emissions result when vehicles are scrapped. Taking all vehicles with air conditioning registered in Germany, this means that

emissions of partially fluorinated hydrocarbons from this source hence total around 1.5 million tonnes (t) of CO_2 equivalents for the year 2000. The trend is rising. Today, this already corresponds to almost one fifth of all HFC emissions.

Although regular maintenance can increase the reliability of an air conditioning systems in cars, this does not reduce refrigerant emissions. Some manufactures have developed alternative air conditioning systems using CO_2 as a refrigerant; these systems are currently undergoing trial testing. Their market launch can be expected in the next few years.

The study titled "Emissionen des Kältemittels R 134a aus mobilen Klimaanlagen" [Emissions of the refrigerant R 134a from mobile air conditioning systems] is available on UBA's website at: www.umweltbundesamt.de. *(III 1.4)*

Ceramic fibres in products

On 3 December 2001, UBA held an expert public meeting on the subject of ceramic fibres in products. The reason for this is the difficulties with the different levels of protection when handling mineral wools – their dust can lodge over long periods of time in the lung – and ceramic fibres.

The use of ceramic fibres in products and – in particular – in consumer goods is still a very controversial issue. Carcinogenic fibre dust from these products, initially considered to be primarily a work-protection issue, is proving to be difficult in terms of environmental and general health protection – what is also difficult here is that it is not mandatory to label products containing ceramic fibres.

Under European law, substances and preparations containing ceramic fibres must be identified (among other things, with an R 49 warning notice, i.e. "May cause cancer by inhalation"). Furthermore, substances and preparations that are marketed and intended for sale to the general public may not contain single concentrations of more than 0.1 weight percent; otherwise they may not be marketed in the European Union. This, however, does not apply to products with which consumers come into contact.

This results in a paradox situation where consumers (just like staff in small manufacturing companies) are in fact protected against biopersistent mineral wools and their fibre dust, but not against the often more dangerous fibre dust from ceramic fibres. There are neither any bans (on production, use, marketing) nor is there any obligation to label. In contrast to large industrial companies, there is also a lack of awareness among the general public for the problems which these substances and their dust pose. These different approaches with biopersistent mineral wools and ceramic fibres is unacceptable from the point of view of health protection and has often led to confusion.

The result of the expert meeting showed that the regulations for biopersistent mineral fibres can and must be in most cases expanded to include ceramic fibres. UBA has now proposed expanding the bans on the production, use and marketing of bio-persistent mineral fibres for the purpose of heat and sound insulation in buildings – including technical insulation on glassy and polycrystalline ceramic fibres – contained in the *Chemicals Banning Ordinance* und der *Hazardous Substances Ordinance*. *(III 1.4)*

Standardizing environmentally safe and healthy construction products

In order to facilitate the free trade of construction products within the European Union, the EU Council adopted in 1989 the *EC construction product directive* which, based on the "new approach", foresees that European standards harmonize the different requirements of the member states. Due to the different traditions and regulations, it was not possible to publish the first of these standardized construction product standards until 2001. The 1,000 test and product standards foreseen will be published over the next four to five years. From the very beginning, it was clear to all those involved – authorities, consumers, manufactures – that construction products can – due to their material diversity – contain and emit substances that can have a detrimental effect on the environment and human health. The European standards must hence determine how the use of such substances can be restricted.

How can this work in practical terms? How can the protection level achieved in Germany remain intact? Which potentially hazardous substances are contained in construction products, which hazardous substances are emitted in critical amounts into the environment and indoor air? Which limits must be adhered to in order to protect man and the environment, which test methods are to be used in order to

monitor adherence to these limits? There is still confusion and no consensus with regard to these issues among those involved in the standardization of construction products.

This is why UBA has initiated activities designed to promote these substance-based requirements: On behalf of UBA, Deutsches Institut für Bautechnik (IfBt) is working on a research project that will link the state of knowledge on content substances, emissions, regulatory status and testing methods throughout Europe to form a reference framework.

The laws and administrative regulations governing hazardous substances that are to be observed in Germany with a view to construction products were compiled for the EU Commission.

This list is available on the Internet to those involved in the standardising process at: europa.eu.int/comm/enterprise/construction/internal/hygiene.htm.

(III 1.4)

Information on low-solvent products

Emissions of volatile organic compounds (VOCs) in the summer months are primarily responsible for the formation of photochemical smog (summer smog). The greatest share of VOC emissions comes from solvents and products containing solvents (emissions in 1999: around 1 million tonnes) primarily from "processing of paint and ink", "adhesive processing", "the printing industry" as well as "surface cleaning". The *EU Solvents Directive (directive 1999/13/EC)* together with its implementation in German law in the *31. Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (31. BImSchV)* [31st ordinance on the implementation of the Federal Imission Protection Act] of 21 August 2001 have now obliged operators, above all, of plants that do not require approval to observe stricter requirements for limiting VOC emissions. For smaller plants and most importantly for open applications in small manufacturing businesses or in the case of private end users, there are no technologies for exhaust filtering, or they are unreasonably expensive. In order to be able to reduce VOC emissions here also, an instrument is needed that focuses on product-based measures.

In order to support the small and medium-sized businesses affected – especially small manufacturing companies – UBA commissioned the Fraunhofer Institute for Systems and Innovation Research in Karlsruhe to carry out a research project. The project drafted comprehensive stocktaking of low-solvent products on offer and the application techniques available for these for varnish and paints, adhesives and surface cleaning, as well as for the printing industry. This information was converted to a "knowledge store" and is now available on the Internet to all users of products containing solvents.

The final report titled "Einsatzmöglichkeiten lösemittelarmer Produkte – Wissensspeicher zur Förderung von Innovationen in der lösemittelverwendenden Industrie" [Application possibilities with low-solvent products – knowledge store to promote innovation in the solvent-using industry] will be available in the TEXTE series and from Werbung + Vertrieb (box on page 145). *(III 1.4)*

Department III 2:

Branches of Industry

Evaluating environmental burdens caused by plants

How can the more environmentally favourable production method be identified if several comparable techniques are available? This was the topic of two research projects on behalf of UBA where by June 2001 a method was developed that offers a comprehensive evaluation of the various environmental burdens of different techniques and which is still transparent and comparatively easy to use. These projects were carried out by DFIU as well as Arcadis, Trischler & Partner (AT & P) in Darmstadt, and ifeu – Institut für Energie- und Umweltforschung in Heidelberg. The method is designed particularly to simplify complex problems, for example, if techniques are compared which have adverse effects on different media (emissions into the air in comparison to waste-waster discharge) or where burdens affect different areas (energy consumption in comparison to emissions of toxic substances).

The relevant burdens of the techniques are standardized and compared on the basis of a simplified method using an eco-balance sheet.

A follow-up project has been underway since July 2001 where the solutions to the problems are being

put to the test under realistic conditions. The results support the direct implementation of the *EU Integrated Pollution Prevention and Control Directive (IPPC Directive)* which demands that pan-media aspects be considered during plant approval procedures. Concrete environmental pan-media conflicts are to be evaluated with this method, particularly in the EU Best Available Techniques Reference Documents (BREFs) that are relevant for plant approval.

(III 2.1)

Biological tests for waste-water control

In the case of certain industrial sectors in Germany – for example, in the chemical industry – requirements exist to restrict the toxic impacts of waste water and this is checked using biological tests. Very different methods and concepts are in use here. Throughout Europe, no agreement has yet been reached in this context on uniform waste-water tests. The Whole Effluent Assessment (WEA) workgroup of the Oslo Convention for the Protection of the North-East Atlantic (OSPAR) has worked out the additional benefit (in conjunction with chemical/physical testing) of different biological tests for waste-water testing. This group is working on creating suitable, standardised application concepts. One foundation for this work is the OSPAR strategy with regard to hazardous substances, according to which priority substances (primarily hazardous substances contained in an OSPAR list) may no longer enter the marine environment after 2020.

UBA is represented in this work group and has been supporting these activities since June 2001 with a research project that aims to draft measures for the reduction of toxic, persistent and bio-accumulating properties in industrial waste-water. In the first phase of this project, reports were compiled on the experience and application of impact tests on mutagenity and endocrine effects. In the second phase, suitable test methods for the application of waste-water control parameters are identified. *(III 2.1)*

EU directive on large combustion plants

The new *EU directive on large combustion plants (Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants)* came into effect on 23 October 2001. UBA was largely involved in these negotiations. The directive is applicable to combustion plants with a rated thermal output of 50 Megawatt (MW) or more. New provisions were included for gas turbines. Compared to its predecessor directive, the emission limits for sulphur oxides, nitrogen oxide and dust have been reduced significantly on the basis of technological progress. Special mention must be made to the fact that regulations were also included in the directive for existing plants. This directive must be implemented in national law by the end of November 2002.

(III 2.2)

Reduction of dust and dioxin emissions from an electric steelworks

Electric steelworks use scrap iron and, above all, scrap steel. The scrap is melted down to crude steel in electric arc furnaces. This process can induce considerable emissions of dust and gaseous organic substances, such as dioxins and furans. Furthermore, significant quantities of heavy metals – such as cadmium, mercury, nickel, lead, copper and zinc – can be emitted. In a project at Salzgitter AG in Salzgitter which was backed by funds from the Federal Ministry for the Environment's (BMU) investment programme for the reduction of environmental burdens, a modern exhaust filter method was used on one of the DC electric arc furnaces. This particularly reduces dioxin and furan emissions. Emissions of the highly toxic heavy metals cadmium, mercury, nickel as well as lead are lower than the limits set by the new *Technical Instructions on Air Quality* (*TA Luft)*.

The final report on "Verminderung des Schadstoffgehaltes insbesondere an PCDD/PCDF in den Abgasen eines Elektrostahlwerkes" [Reduction of pollutants, in particular PCDD/PCDF, in emissions from an electrical steel works] is available on loan under No. 2069 from UBA's library (address on page 2).

(III 2.2)

Reduction of nitrogen-oxide emissions in a cement works

The world's first large-scale technical facility for selective catalytic nitrogen-oxide reduction (SCR) was set up with the backing of UBA in the cement works of Solnhofer-Portland-Zement in Solnhofen. The cement works has a production capacity of around 1,400 tonnes per day (tpd) of cement clinkers.

The reactor for the catalytic reduction of nitrogen-oxide was installed next to the building for the four-stage cyclone pre-heater, and is arranged in the exhaust gas system between the cyclone pre-heater and the dust filter. Before entering the reactor, water with 25% ammonia is injected as a reduction agent into the exhaust current of around 100,000 cubic metres per hour (m^3/h). The exhaust gas in the reactor has a temperature of around 340 °C and a high dust content of around 80 grams per cubic metre (g/m^3). A honeycomb catalytic converter based on titanium dioxide(TiO_2) is used which has already been tried and tested in power stations and waste incineration plants.

The SCR facility successfully went into operation in 2001. Comprehensive tests are currently underway, for example, on efficiency, catalytic activity, ammonia escape, maintenance effort as well as on energy and ancillary equipment demand. With the SCR method, NOx concentrations in emissions were reduced from 1,300 and 2,000 milligrams per cubic metres (mg/m^3) to values of below 200 mg/m^3.

(III 2.2)

Integrated environmental protection in the ceramics industry

On behalf of UBA, Deutsch-Französisches Institut für Umweltforschung (DFIU) [German/French institute for environmental research] at Universität Karlsruhe has examined the practical implementation of integrated environmental protection in the ceramics industry. This work was closely accompanied by UBA as well as by representatives from the two nations and from industry. A national position paper was prepared that is to be included in the pending work on the "Ceramics Industry" BAT reference document (refer to chapter 10).

The position paper is based on the structure of the BAT reference document and contains information on the structure of the ceramics industry in Germany, the economic performance of the production branches, as well as on techniques for reducing hazardous emissions. In this context, fundamental process parameters and environmentally relevant input and output flows are identified.

The final report titled "Exemplarische Untersuchung der praktischen Umsetzung des integrierten Umweltschutzes in der keramischen Industrie unter Beachtung der IVU-Richtlinie und der Erstellung von BVT-Merkblättern" [Exemplary examination of the practical implementation of integrated environmental protection in the ceramics industry with a view to the IPPC directive and the preparation of BAT reference documents] is available on loan from UBA's library under No. UBA-FB 000240 (address on page 2).

(III 2.2)

Dust when storing and handling bulk material

Loose bulk materials – such as ores, metals coal, fodder and fertilizers, grain and other substances in the minerals industry – are important sources for diffuse dust emissions.

In 1999, UBA commissioned the companies of Prognos in Berlin and Ecoteam in Trier to carry out a research project on this topic. This project was successfully completed in 2001.

The final report provides a comprehensive overview of the methods used in the storage, transport and handling chain with bulk goods, and also features the details of research into emission-relevant points within process chains. The handling and storage techniques for bulk goods have been improved in recent years, and considerable reductions in dust emissions have been achieved, so that specific total dust emissions from the storage and handling of solid bulk goods have declined in relation to the tonnes of bulk goods.

The final report titled "Emissionen staubender Massenschüttgüter" [Emissions from dust-causing bulk goods] is available on loan under No. UBA-FB 299 94 304 from UBA's library (address on page 2).

(III 2.2)

Revision of the Waste Oil Ordinance

The collection and disposal of waste oil is governed by the *Waste Oil Ordinance (AltölV)* of 1987. In Germany, around 500,000 tonnes (t) are collected every year. This waste oil is primarily regenerated, this means that up to over 60 % of this oil is used to produce new lubricants or fuels that replace fuel oil. In a court decision from September 1999, the European Court of Justice demanded that Germany, in line with the EU's *Waste Oil Directive 75/439/EEC*, give priority to the regeneration of waste oil in its national legislation.

UBA is supporting the work on revising the Waste Oil Ordinance in many ways, for example, by examining the ecological evaluation of the most important waste-oil processing methods. For this purpose, waste-oil was broken down into collection categories. The processing of used engine oil, gear oil, as well as mineral hydraulic oil, which account for around 80 % of all waste oil, to produce new lubricant is to become mandatory.

The results of this examination form an important contribution towards revising the Waste Oil Ordinance which awards priority to regeneration. The revised ordinance came into effect on 1 May 2002. In a research project, UBA is also examining how simple test methods can be used to check the regenerative capacity of waste oil as early as during collection. The examinations with different sensors are being carried out by the Fraunhofer Institute for Microelectronic Circuits and Systems in Duisburg/Dresden. *(III 2.3)*

Environmentally compatible ventilation of inland waterway tankers

Up to now, inland waterway tankers with no fume-recovery systems have released the remaining petrol/air mixture into the atmosphere after unloading their petrol cargo and before taking new cargo on board or whilst docked. During this ventilation process, around 2 tonnes (t) of volatile organic compounds (VOCs, hydrocarbons) are released. This is to stop in the near future: Starting 1 January 2006, it will no longer be permitted to emit petrol fumes during ventilation processes. This requirement of the *20. Bundes-Immissionsschutzverordnung (20. BImSchV) [20th Federal Immission Protection Ordinance]* corresponds to stricter implementation of the EC VOC directive (*94/63/EC, directive on the control of volatile organic compounds (VOC) emissions resulting from storage of petrol and its distribution from terminals to service stations)* in Germany. The Zentralkommission für die Rheinschifffahrt (ZKR) [Central Commission for Rhine Shipping] has established a work group in which UBA is involved. The aim here is to ensure a standardized procedure in order to avoid ventilation processes.

In order to support this work, UBA has commissioned the Fraunhofer Institute for Atmospheric Environmental Research in Garmisch-Partenkirchen to carry out a research project.

The final report will also feature technical and organizational solutions that are suitable for the environmentally friendly ventilation of tankers using land-based fume recovery systems. Furthermore, diffuse VOC emissions were measured for the first time during the loading and unloading of inland waterway tankers and a reference document was prepared for inland waterway shipping companies and storage operators.

The report titled "Verminderung gasförmiger Emissionen beim Transport von Ottokraftstoffen und Mineralölprodukten mit Binnenschiffen (20. BImSchV)" [Avoidance of gaseous emissions during the transport of petrol fuels and mineral oil products with inland waterway vessels] is available on loan from UBA's library under No. 000 255 (address on page 2). *(III 2.3)*

Recovering used catalysts from the chemical industry

In chemical production, a host of catalysts (so-called contacts) are used in order to accelerate reactions. The development of catalysts is up to now one of the most important areas of research in the chemical industry. The catalysts currently in use and the resultant substance flows for re-use, for recycling in other areas or for disposal have been compiled in a study. This study, on behalf of UBA, was carried out by the expert Dr. Ali Hassan, Technische Universität Berlin, within the scope of an investment programme by the BMU. The results show that there is still considerable potential when it comes to recovery and material recycling – above all, of non-precious metal catalysts, as well as of the zeolites and the acid-base catalysts – because many recycling possibilities have yet to be used.

The study titled "Rohstoffeinsparung durch Kreislaufführung von verbrauchten Katalysatoren aus der chemischen Industrie" [Saving resources by recycling used catalysts from the chemical industry] (TEXTE 01/21) is available from Werbung + Vertrieb (box on page 145).

Low-waste manufacture of an intermediate for antibiotics

7-Aminocephalosporanic acid (7-ACA) is an important intermediate in the production of antibiotics. This intermediate can be produced using chemical or biotechnical processes. One major disadvantage of

the chemical production method is the process-related high level of around 30 tonnes (t) of waste per tonne of 7-ACA that must be incinerated. In the case of the method based on enzymes, the level of waste generated is below one tonne. The product quality is, however, significantly poorer than that of the chemically produced 7-ACA.

In a project carried out at BC Biochemie, Frankfurt/Main, on behalf of UBA and financed by the BMU's investment programme on the reduction of environmental burdens, the enzyme-based process was optimized in order to save resources and reduce waste. This has been achieved. Furthermore, the quality of the product has been improved significantly. Continuous chromatographic cleaning of 7-ACA – instead of the discontinuous process – resulted in savings of 40,000 tonnes per year (tpa) of sodium acetate solution alone and 20,000 tpa of methanol. The savings in input materials and the reduction in waste are confronted by an increase in waste-water quantities compare to the chemical process. The substances contained in the waste water, however, are more easily decomposed.

The final report titled "Enzymatische Herstellung der 7-ACA" [Enzymatic manufacture of 7-ACA] is available on loan from UBA's library under No. 20028 (address on page 2). *(III 2.3)*

Less pollution of waters by Czech chemical plants

The Elbe is heavily polluted by immissions in the Czech Republic. A project for the reduction of waste-water burdens with organically bound halogens (AOX) was carried out at the Czech company of Spolchemie in Usti nad Labem in order to help the Czech Republic to bring its industry in line with the state of the art for waste-water treatment. This project was backed by funds from the BMU's investment programme and technical support from UBA.

The AOX freight in the raw waste water from epichlorhydrine production was reduced by 90 %. On the whole, the AOX freight of Spolchemie was reduced by 73 %; this corresponds to around 106 tonnes per year (tpa).

The final report titled "Verminderung der Belastung des Abwassers der Spolchemie in Usti" [Reducing the burden of waste water from Spolchemie in Usti] is available on loan from UBA's Chemical Industry, Mineral-oil Industry unit (address on page 2). *(III 2.3)*

Waste-water free production processes

The *Waste-water Ordinance* promotes the use of water-saving measures in order to reduce pollutant emissions and to boost the efficiency of waste-water treatment plants by concentrating waste-water flows. A research project by the Institut für Umwelttechnik und Management at Witten/Herdecke University, which was carried out on behalf of UBA, described possibilities for implementing waste-water free or low waste-water processes. The preconditions and limits for converting to water-efficient – right through to waste-water free – production processes were presented and compiled in a criteria catalogue. The results of the project offer a foundation upon which the Best Available Techniques Reference Documents (BREFs) pursuant to the EU's IPPC directive can be prepared (refer to chapter 10).

The final report titled "Untersuchungen zum Einsatz abwasserloser Produktionsprozesse in der chemisch-pharmazeutischen Industrie" [Examining the use of waste-water free production processes in the chemical/pharmaceutical industry] is available on loan form UBA's library under No. UBA-FB 299 26 306 (address on page 2). *(III 2.3)*

Measures to combat summer smog

On 25 August 2001, the *Solvents Ordinance* came into force in Germany. This marks the implementation of the *EU Solvents Directive (Directive 1999/13/EC)* in German law. Organic solvents are significant precursor substances in the formation of unwanted ozone in the lower layers of the atmosphere and hence partly responsible for the occurrence of health-impairing "summer smog". The aim of this ordinance is to reduce the emission of organic solvents during their application by a further 250,000 tonnes a year.

This ordinance covers a very wide range of activities: from painting, printing, adhesives, to textile cleaning right through to the production of shoes and pharmaceuticals if their solvent consumption exceeds an industry-specific threshold. The ordinance specifies emission limits for diffuse and natural exhaust gas.

Overall emission limits are defined for certain industries, i.e. only a limited amount of solvents may be emitted per coated surface or per product manufactured. The Solvents Ordinance basically permits alternative means of adhering to the respective limits, provided that they ensure equivalent reductions in emissions.

This form of approach is a new instrument. The aim here is to promote process-integrated emission reductions and to provide plant operators with the opportunity to implement solutions "tailor-made" to their plants. Particularly for smaller plants, which did not require approval up now, the emission-reduction plans offer an affordable and ecologically useful alternative to downstream flue gas cleaning. *(III 2.4)*

Practical implementation of the Solvents Ordinance

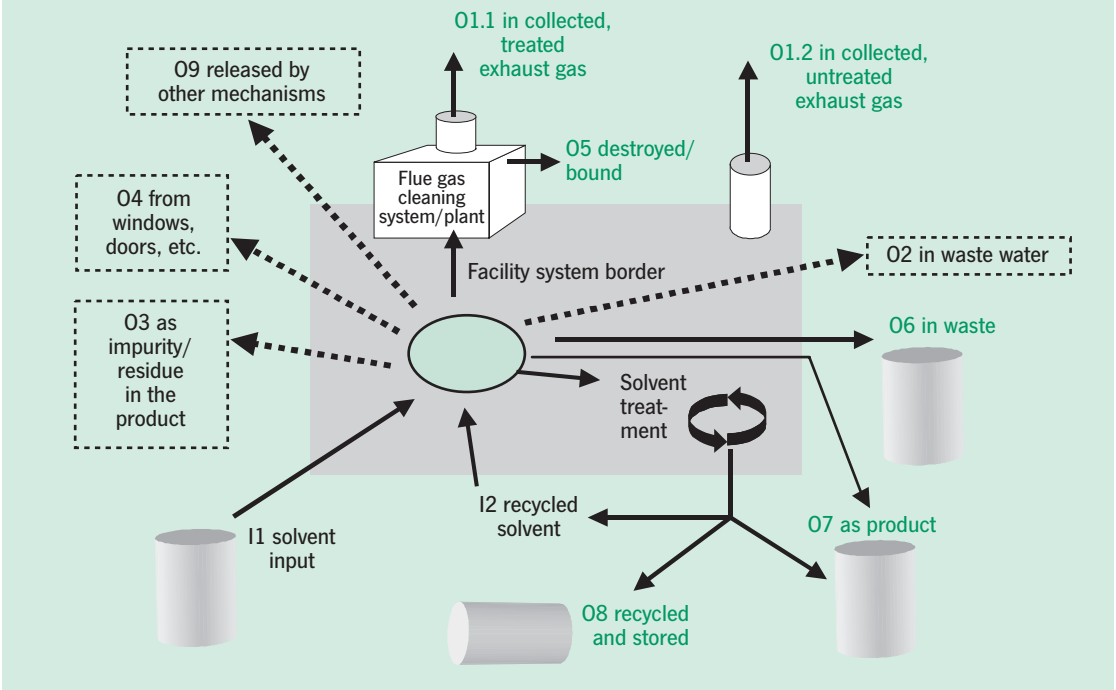
Many small plans that do not require approval are subject to the provisions of the Solvents Ordinance. Operators must now draft annual solvent balances (Figure 31) and – in as far as necessary – emission reduction plans. These solvent balances and reduction plans are new instruments of German emission protection legislation. Plant operators, enforcement agencies and plant manufacturers still lack information and experience when it comes to handling these instruments. This is why a research project by UBA examined the sometimes difficult problems that can arise during the practical preparation of solvent balances and reduction plans in the relevant application areas, such as painting shops. This hence offers prompt practical assistance for both companies and supervision authorities. This project was completed at the end of 2001.

The final report titled "The Solvents Ordinance – Introduction and Suggestions for its Practical Implementation" is available from UBA's Central Services Unit (box on page 145). The text can also be downloaded from the Internet at: www.umweltbundesamt.de, under "Publications". *(III 2.4)*

Processing of ceramic fibres mineral fibres

As part of the revision of the *Technical Instructions on Air Quality Control (TA Luft),* UBA commissioned two studies in which weight and fibre-count concentra-

Figure 31: Solvent input/output according to the solvent balance



I = Input, O = Output

tions in exhaust emissions were examined from factories manufacturing ceramic fibres, friction lining, rock wool and glass wool.

The Gesellschaft für Schadstoffmessung und Auftragsanalytik GmbH (GSA) in Neuss-Norf carried out measurements at production plants for ceramic fibres and friction lining. The emissions examined contained very low levels of dust concentration, because highly efficient dust separators were used to filter exhaust emissions. The fibres are normally classified as being carcinogenic. No clear correlation was found between fibre concentration and total dust concentration levels in exhaust emissions.

The Gesellschaft für Umweltschutz TÜV Nord mbH in Hannover carried out the first-ever fundamental examination of exhaust emissions in the glass wool and rock wool production. Different fibre concentration levels were found in the exhaust emissions, depending on the type of dust extraction system used. These glass wool and rock wool fibres are not classed as being carcinogenic.

The report titled "Messprogramm zur Massen- und Faserzahlkonzentration aus Anlagen zur Herstellung und Verarberitung von Keramikfasern und Mineralfasern" [Measuring programme for weight and fibre-count concentration levels from plants manufacturing and processing ceramic fibres and mineral fibres] is available from UBA's Unit III 2.4 "Maschinen- und Fahrzeugbau" [Mechanical Engineering and Vehicle Construction] (address on page 2). (III 2.4)

Optimization of the Packaging Ordinance

In October 2001, a Federal-government/Federal-state working group on the *Packaging Ordinance (VerpackV)* in which UBA was involved drafted a report that focuses on possible improvements in the existing system of collecting, sorting and recycling packaging. The reason behind this was a motion for a resolution by the German Bundesrat on 29 May 1998 which demanded the establishment of a Federal-government/Federal-state working group which was to focus its efforts on the search for ways to ecologically and economically optimize the existing recycling system for packaging materials. Based on a report by the engineering firm HTP in Aachen and ifeu – Institut für Energie- und Umweltforschung in Heidelberg (refer also to UBA's 2000 Annual Report), certain small-parts plastic and composite packaging was found to have hardly any ecological benefits and to be particularly negative from an economic point of view.

Although the exclusion of such packaging from the separate material collection and its disposal via residual waste that is completely or partially recycled for energy or raw materials did bring mean some benefits in terms of costs, the working group did find considerable legal problems: The exclusion of the aforesaid packaging from the regulatory scope of the Packaging Ordinance also means that it is dismissed from the regime of product responsibility. As a compensatory measure, special duties would have to be levied.

If product responsibility were to be maintained whilst the aforesaid packaging is collected via the residual waste bin, then certain principles of the *Recycling and Waste Act (KrW/AbfG)* would have to be partially modified – in particular with regard to the priority awarded to the ecologically more beneficial disposal method. However, this would mean that there would be no incentive for the business sectors affected to use simple and high-quality reusable packaging. Furthermore, the majority of the Federal states were in favour of fundamentally keeping the existing recycling system, of technically optimizing this and perhaps opening the system up for further materials. *(III 2.5)*

Department III 3:

Waste and waste water management

Transfrontier movement of waste

UBA is responsible for approving shipments of waste through Germany. In 2001, all applications submitted were approved (Table 17). UBA's approvals also contain restrictions and information concerning special procedures to be adopted particularly in Germany. Regulatory intervention on the part of UBA was required in some cases following approval. For example, there were unreasonably long intermediate storage periods and transfer stations that were not approved were used.

UBA also manages statistics on imports and exports of waste that require approval. In 2000, there was an import surplus for the first time ever. Imports totalled around 2 million tonnes (t) whilst exports reached 1.6

million tonnes (Table 18). Compare this to: Foreign trade statistics record an import of waste not subject to approval of 8.5 million tonnes and an export of 16 million tonnes.

In order to punish illegal shipments of waste in 2000, the authorities responsible have issued 35 fines and the courts have passed sentence in two cases. Police crime statistics list 150 crimes for this period which, however, were reduced by a pooling of proceedings and dismissal of proceedings or later by an acquittal to the aforesaid number of persons sentenced.

The Federal Office for Freight Transport (BAG) checks around 600,000 HGVs every year in order to detect crime.

Comprehensive statistics are available on the Internet at: www.umweltbundesamt.de, under "Grenzüberschreitende Abfallverbringung" [Transfrontier movement of waste]. Detailed information on approval application procedures, including the latest legal provisions, is to be found in the "Praxishandbuch zur grenzüberschreitenden Abfallverbringung" [Practical hand-book on transboundary waste shipments], Erich Schmidt Verlag, Berlin, 2000, ISBN 3-503-05957-1 (available at bookstores). *(III 3.1)*

Interpretation of the Recycling and Waste Act

The enforcement of the *Recycling and Waste Act (KrW/AbfG)* clearly showed that the intended reorganization of the waste sector can only be achieved when the core terms of this act are interpreted nationwide in line with the targets and principles of the act. This is why just briefly after the Recycling and Waste Act came into force, the Federal government and the Federal states adopted an interpretation of the term waste as well as a distinction between waste recycling and waste disposal.

For its part, UBA has awarded a two-part research project that is dedicated to further interpretation of additional provisions as well as uncertain legal terms of the act.

In the first part of the project, Prof. Dr. Walter Frenz, Technische Hochschule Aachen, subjected further key terms of the recycling regime of the Recycling and Waste Act to a thorough legal/scientific exmaination in light of current court decisions. The study offers scientifically founded, enforceable criteria as a basis for the standardized application of the act, in particular for the details of the recycling obligations to be reflected in statutory instruments as well as the requirements placed on correct, harmless and high-quality recycling.

In the second part of the project, the law firm of Gaßner, Groth, Siederer & Coll. in Berlin is working on interpretation issues in conjunction with public and private waste disposal, as well as on exceptions to the

Table 17: Approval of shipments of waste through Germany issued by UBA since 1995

Year	Number of applications	Number of waybills	Quantity transported [tonnes]
1995	174	570	15,000
1996	161	2,300	60,000
1997	181	1,940	75,000
1998	189	2,130	180,000
1999	200	2,350	290,000
2000	221	3,630	400,000
2001	270	4,190 *	440,000 *

* Preliminary figure

Table 18: Flows of waste subject to approval of more than 20,000 tonnes in exports in the year 2000

Importing country	Type of waste	Quantity [tonnes]
Italy	Treated wood	380,000
France	Blast-furnace slags	302,000
Sweden	Treated wood	137,000
France	Contaminated gypsum	60,000
Switzerland	Settlement waste	39,000
Netherlands	Contaminated soil	37,000
Austria	Treated wood	33,000
France	Paper sludges	28,000
UK	Waste oil	27,000
France	Zinc-containing waste	26,000

scope of the Recycling and Waste Act and to the general supervision. The authors also refer to the term of "primarily public interest" and the legal nature of approval. Furthermore, criteria are being prepared related to the reliability of third parties contracted for disposal services and to the scope of responsibility on the part of the customer.

The final part of the study is dedicated to distinguishing waste legislation from animal carcass disposal, mountain and water legislation as well as from the legislation for the disposal of weapons.

The study titled "Grundlagen der Abfallverwertung" [Principles of waste recycling] is available as Volume 1992 in the series "Schriften zum Umweltrecht" [Documents on the Environment] and published by Duncker & Humblot, Berlin. It is available at bookstores (ISBN 3-428-10574-5).

The study titled *"Rechtliche Grundsatzfragen der Auslegung der neuen abfallrechtlichen Vorschriften"* [Fundamental legal issues in the interpretation of the new waste legislation requirements] *(TEXTE 39/01)* is available from Werbung + Vertrieb (box on page 145). *(III 3.1)*

What can be done with appliances containing PCBs?

Council Directive 96/59 EC on the disposal of polychlorinated biphenyls (PCBs) and polychlorinated terphenyils (PCTs) – in part implemented by the *PCB/PCT waste ordinance* of 26 June 2000 – requires two things: a stock-taking of individual appliances that contain more than five litres of PCBs as well as a plan for the residual quantities yet to be disposed of. Furthermore, since 1 January 2000, appliances containing PCBs may only be operated with exceptional approval pursuant to the *Ordinance on Hazardous Substances (GefahrstoffV)*. With a view to the obligation to report to the European Union (EU), UBA, together with the ministries for the environment in the Federal states, has listed the exceptional approvals for the continued operation of appliances containing PCBs and the quantities of PCBs to be disposed of as per 1 January 2001. Furthermore, plants in Germany that dispose of waste containing PCBs were also identified in conjunction with this work.

Result: The by far greatest part of the appliances subject to the ban have now been taken out of operation and are already disposed of. The remaining quantities can be dealt with by the existing disposal capacities. The Federal government reported these findings to the EU Commission on 23 March 2001. The Commission, however, is of the opinion that Germany has failed to meet with its reporting obligation and hence filed a complaint on 20 November 2001 with the European Court of Justice. The Federal government will contest against this complaint. *(III 3.2)*

Special waste

Pursuant to Article 5 of *Council Directive 91/692 EEC on the standardizing and rationalizing of reports on the implementation of certain directives related to the environment,* the EU member states must submit status reports on special questionnaires every three years. Waste requiring particular monitoring – so-called special waste (pursuant to EU legislation: hazardous waste) – is also subject to Council Directive 91/689 EEC on hazardous waste.

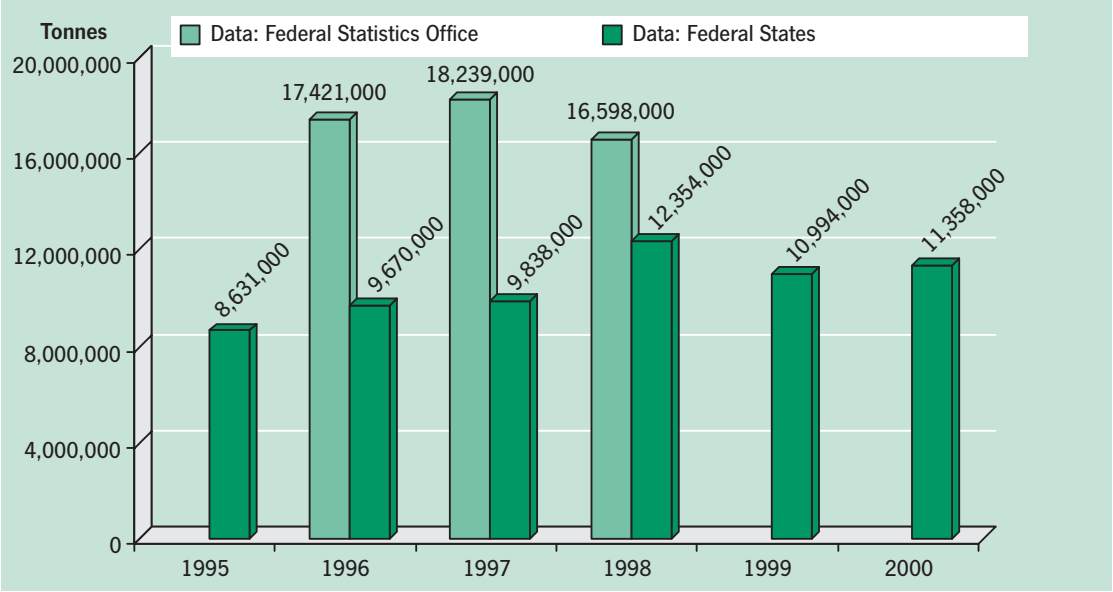
The latest polls in the period between 1998 and 2000 were completed in September 2001. The polls are based on the details made available by the Federal states. Based on these reports, UBA has calculated and compiled the total quantities of special waste and – following co-ordination with the BMU – has passed this on to the European Environment Agency (EEA) in Copenhagen (Figure 32). *(III 3.2)*

Landfill closure programme

The *Technical Instructions on Municipal Waste* from 1993 declares the pre-treatment of municipal waste to be binding. This regulation has become even more binding since the *Ordinance on Waste Storage (AbfAblV)* came into effect on 1 March 2001. As a result of this ordinance, effective as of 1 March 2001, waste can no longer be deposited without pre-treatment. Only a few exceptions under certain preconditions are permitted until 31 May 2005. Furthermore, landfills that fail to meet with the requirements of this ordinance must be closed by 2005 or 2009. This regulation is based on *Council Directive 1999/31 EU on the landfill of waste* which is to be implemented in national legislation.

Today, increased recycling measures have already led to excess capacity among landfills. How can this be eliminated? This question is to be examined by the research project titled "Examining legal, organizational

Figure 32: Quantities of special waste in Germany



and/or economic approaches for closing landfill capacity among municipal waste landfills" which is to be completed in December 2002.

The study is to examine the legal possibilities and restrictions for closing landfills and at the same time point out ways in which the expected financial problems can be alleviated by a long-term approach. This examination will focus particularly on how financial gaps can be closed in the event of insufficient reserves for a landfill closure, for example, via waste duties on landfills still in operation, general tax, landfill duties and co-operation solutions (merging to form larger disposal associations). The solutions that already exist or are planned on a Federal-state level for closing down landfills are also to be examined. *(III 3.2)*

Experience with animal meal disposal

The guideline on the "Technical requirements and general recommendations for the disposal of animal meal and animal fat in incineration plants", which was drafted on behalf of the BMU and under UBA's expert supervision, offers 60 pages of information on technical requirements. It provides operators of treatment plants – based on the status of knowledge as per January 2001 – with recommendations for handling these substances. Meanwhile, further practical experience has been gained in the use of animal meal and animal fat in a series of waste incineration plants (around 15 plants for municipal and special-waste incineration), a sewage-sludge incineration plant (Lünen), in a number of cement factories (for example Alsen AG, Breitenburg and Höver works; Breisgauer Zementwerke, Geisingen works; Heidelberger Zement AG, Leimen works) and power stations (for example, the Staudinger Großkrotzenburg works, Lünen), from an internally operated furnace system (ZWS), a paper factory in Osnabrück and a steelworks in Bremen.

The guideline titled "Technical requirements and general recommendations for the disposal of animal meal and animal fat at incineration installations" is available on the Internet at: www.umweltbundesamt.de or www.bmu.de. *(III 3.3)*

EU directive waste incineration plants

On 28 December 2000, the new *EU waste incineration plant directive (Council directive 2000/76 EU on the incineration of waste)* came into force. After around four years of talks in which UBA was directly involved, minimum, standardized European requirements were defined for waste incineration which are to be implemented in national law in the member states by 28 December 2002. The requirements of the new directive for the operation of plants for waste incineration and plants incinerating waste in conjunction with other matter reflect an approach that clearly encompasses all environmental media in order to protect the air, soils, wa-

ters and climate. Apart from new emission limits for air-polluting substances (both for waste incineration plants as well as for industrial plants that incinerate waste together with other matter), the directive also contains emission limits for the discharge of waste water from exhaust filtering as well as a first-time ever restriction for the content of organic substances contained in slags and grate ash (combustion quality) and the obligation to use the heat generated during the incineration or combined incineration of the waste. *(III 3.3)*

German activities for the implementation of the EU directive on waste incineration

The new *Council Directive 2000/76 EU on the incineration of waste* more or less corresponds to the scope of validity of Germany's *Ordinance on incineration plants for waste and similar combustible materials (17. BImSchV)* of 23 November 1990 in which almost the same emission limits are defined for air-polluting substances from waste incineration plants. Modifications of this ordinance result primarily with regard to the more detailed requirements set forth in the EU directive for the incineration of waste with other matter which were taken into account in a first work draft, jointly prepared with the BMU, for the revision of the Ordinance on the incineration plants for waste and similar combustible materials (17. BImSchV). The emission limits that result from the pan-media approach of the EU directive on waste incineration for the discharge of waste-water from exhaust emission filtering is to be implemented in Germany law with the fifth ordinance for the revision of the waste-water ordinance. This ordinance with appendix 33 "Washing exhaust emissions from the incineration of waste" was adopted by the Federal cabinet on 8 May 2002. This has yet to be approved by the German Bundesrat. *(III 3.3)*

Status report on the "Waste incineration" BAT reference document

Early in December 2001, the European office for Integrated Pollution Prevention and Control (IPPC Bureau) in Seville (Spain) was the venue for the first meeting to prepare a BAT reference document (BREF, refer to chapter 10) on waste incineration.

The German status report was drafted in co-operation with representatives from the respective industrial associations, plant operators and Federal-state authorities. This report not only describes the plant technology available in Germany for the incineration of municipal waste, special waste and sewage sludge, but also the plants that also incinerate waste with other matter. Furthermore, a special chapter describes so-called "techniques under development" (for example, new rust incineration plants, plants for the gasification of waste, pyrolysis plants and combined methods). The IPPC Bureau will only describe the best available techniques in the BREF on waste incineration. Waste incineration in conjunction with the incineration of other materials is to be described in the reference documents for the respective sectors, for example, for cement factories, power stations, iron and steel. *(III 3.3)*

International advisory activities for thermal treatment of waste

With a view to the requirements for emission reductions for waste incineration and the incineration of waste with other materials as set forth by the new Council Directive 2000/76 EU on the incineration of waste and its implementation in national legislation, some European states – particularly those states hoping to become members of the EU – expressed the need to exchange information. In light of the fact that the regulations of the German Ordinance on incineration plants for waste and similar combustible materials (17. BImSchV) already meant that the new EU requirements have already been in force in Germany since 1990 for waste incineration and the incineration of waste with other materials, many of the candidate countries wished to participate in the experience that had been gained here with approval procedures and the operation of plants. Within the scope of German and European advisory programmes – such as the twinning programme – technical support was provided for the respective ministries in Romania, Slovenia and the Czech Republic. *(III 3.3)*

Implementation of the EU landfill directive in German law

Council Directive 1999/31 EU on the landfill of waste marked the introduction of pan-European, standardised and strict requirements for landfills with which the negative impacts of landfills on the environment and human health can be largely avoided. The EU member states were to implement these requirements in their national legislation within two years. Germany, however, will need one more year for com-

plete implementation. Although the material requirements have been met with and at times even surpassed in Germany for some time now due to existing technical regulations, the EU directives must at least be implemented on the legal level of Federal-government ordinances. The Federal government has already informed the EU Commission that stricter requirements that already exist in Germany will remain in place. Partial implementation for municipal landfills was carried out with the *Ordinance on Waste Storage (Ordinance on Environmentally Compatible Storage of Waste from Human Settlements)* which came into effect on 1 March 2001. Regulations that are still pending are to be adopted by July 2002 with the *Landfill Ordinance (Ordinance on landfills and long-term storage)*. Both ordinances refer to the valid *Technical Instructions (TA) for Waste and Municipal Waste* according to which landfills were approved up to now in Germany. *(III 3.3)*

Leaking canals and defective sewage pipes

Sewage pipes on properties at industrial and commercial sites can have a high risk potential for the environment because hazardous substances are handled in many industries and these substances can enter the ground when internal canal networks are damaged. A research project carried out by the Merseburg branch of Harres-Pichel-Consult was to take a closer look at this.

The result of this project showed that the legal and technical level of regulations (Federal-government, Federal-state and municipal law) are very heterogeneous. The evaluation of the industry-specific condition of sewage led to the conclusion that 45 sewage source areas that are important for this issue can be assigned to three groups with different environmental relevance. Particularly sewage type 3 with a high environmental relevance (eleven source areas with adsorbable organic halogen compounds, aromatic compounds) and type 2 with medium environmental relevance (nine source areas with, for example, heavy metals) can enter the valuable resources of soil and ground water when heavy freights are not retained in the sewage flow from waste-water treatment plants.

Case study examinations of property sewage pipes with typical damage showed no immission into the deeper ground; this was only found in the direct vicinity of the pipes.

The final report titled "Gefährdungspotenzial von undichten Kanälen bei industriellen und gewerblichen Grundstücksentwasserungsleitungen und die Ableitung von Empfehlungen zur Revitalisierung defekter Entwässerungsleitungen" [Potential hazards with leaking canals in industrial and commercial property sewage pipes and the deriving of recommendations for revitalizing defective sewage pipes] (TEXTE 64/01) is available from Werbung + Vertrieb (box on page 145.). *(III 3.5)*

New requirements for industry-specific waste-water discharge

The fourth ordinance for the revision of the waste-water ordinance of 9 July 2001 marked the inclusion of two further industry-specific appendices in the regulatory framework of the *Waste-water Ordinance*. Appendix 19, Part I, determines requirements for the discharge of waste water on the basis of the state of the art for plants generating pulp from wood. This also considered the extraction of pulp based on the sulphate method that has also become established in Germany. This appendix replaces the previously valid *19th Waste-water Administrative Regulation;* Part A (pulp extraction) on minimum requirements for the discharge of waste water into waters of 18 May 1989.

With the new appendix 43 II, requirements for the discharge of waste-water during the processing of rubber and latex as well as during the production and processing of rubber were included for the first time ever in the waste-water ordinance. This nation-wide regulation of what were previously very different regional requirements is intended to ensure greater legal certainty for the factories on a high level of environmental technology.

Article 2 of the *Ordinance on Environmentally Compatible Storage of Waste from Human Settlements and on Biological Waste-treatment Plants* of 20 February 2001 contains a further appendix to the Waste-water Ordinance: In the new appendix 23, the Federal government determines – pursuant to the Federal Water Act (WHG) – requirements for the discharge of waste water into waters which are in line with the state of the art.

The revised Waste-water Ordinance with all the new and continued appendices was announced on 20 September 2001. *(III 3.5)*

The roe test replaces the acute fish test

The procedure issued by Deutsches Institut für Normung (DIN) 38415-6 titled "Giftigkeit gegenüber Fischen: Bestimmung der nicht akut giftigen Wirkung von Abwasser auf die Entwicklung von Fischeiern über Verdünnungsstufen" [Toxic effect on fish: Determining the non-acute toxic effect of sewage on the development of fish roe on different dilution levels] was published in September 2001. (Details of the background story to this new procedure can be found in the 1999 and 2000 annual reports.)

The representatives of Federal-government and Federal-state ministries unanimously agreed to replace the acute fish test (DIN 38412-L31) with the fish-roe test (DIN 38415-6). The introduction is proposed in the *Draft ordinance on the discharge of sewage into waters and for the revision of the appendix to the Waste Water Charges Act (AbwAG)* (Article Act).

The international standardization (International Standardization Organization, the European Committee for Standardization – ISO, CEN) is likely to make it possible to also replace the acute fish test with the fish roe test in chemical testing. *(III 3.4)*

Fish farming according to the state of the art

In Germany, the minimum requirements for the discharge of farm waste from intensive fish farming into waters have up to been subject to the *29th Waste-water administrative regulation (29. AbwVwV)* pursuant to Article 7a the *Federal Water Act (WHG)*.

Following a decision by the European Court of Justice, the waste-water administrative regulations must be converted to legally binding ordinances. Furthermore, pursuant to the 6th amendment of the Federal Water Act, only one uniform technological level, i.e. the state of the art, is to be used.

This is the reason why plans exist to soon abandon the still currently valid 29th Waste-water administrative regulation of 13 September 1983. Based on the draft 5th amendment to the Waste-water Ordinance, no appendix to the Waste-Water Ordinance is to be prepared for this application area, instead a federal paper titled "Information and explanations" is to be issued. The Federal-government/Federal-state discussion circle 61 (GK 61) prepared a draft for this. The guideline nature of this document is intended to ensure a good ecological condition of waters. It is also to contribute towards the uniform enforcement of waste-water legislation. This is also to include closed-circuit plants so that their approval under waste-water legislation can be controlled on the basis of the state of the art.

In light of the revision of the 29th Waste-water administrative regulation (29. AbwVwV) and technical progress in fish farming, a research project by UBA titled "Ermittlung des Standes der Technik für Abwässer aus der Fischintensivhaltung gemäß § 7a WHG" [Identifying the state of the art for waste water from intensive fish farming pursuant to Article 7a of the Federal Water Act] has identified and evaluated substance and process-related information and data on the state of the art in fish farming. This research focused on the information supplied by the GK 61 discussion circle in the draft appendix of spring 1994 and, above all, on the closed-circuit plants.

Solutions have now been proposed for the further avoidance and reduction of waste-water burdens from fish farming based on the state of the art. *(III 3.4)*

Sustainable phosphor management

Within the scope of reorganizing the waste sector, plans exist to initiate phosphor recycling systems. Sewage sludge, animal meal or bone meal, abattoir waste, foodstuff and fodder waste are types of waste that contain phosphor. Following separate incineration of such waste, phosphate can be extracted from the ash and used as a fertilizer.

At the moment, phosphate fertilizers are industrially produced exclusively from imported phosphate of mineral origin. It is becoming apparent that this raw material will become scarcer and hence more expensive world-wide. Phosphor as en element is impossible to replace as a plant nutrient and is urgently needed in crop plant cultivation.

This is why efforts should focus early on developing techniques in order to record the phosphor content of inland waste flows rich in phosphate and to used these to produce fertilizers which are harmless from the point of view of hygiene and are available and effective in terms of plant physiology. Work is currently underway to promote projects of this kind, where possible, in co-operation with other Federal offices. *(III 3)*

Division IV: Safety of Chemicals and Gene Technology

Department IV 1:

Safety of Chemicals – Environmental Assessment

New substances under the Chemicals Act

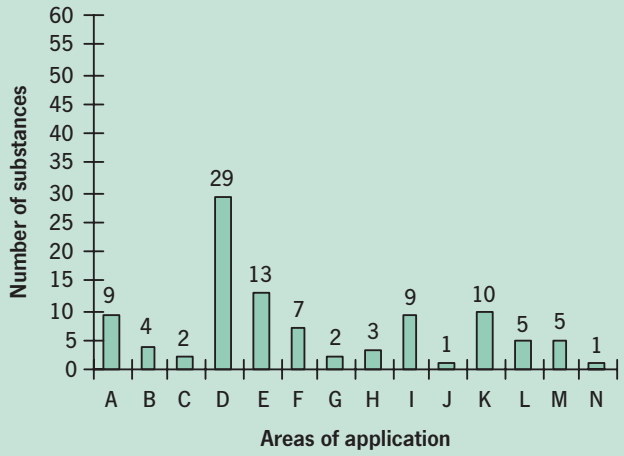
The core elements of the Chemicals Act (ChemG) are compulsory notification and duties to inform for new substances (refer to chapter 11) which are put into circulation in Germany. Within the scope of the enforcement of the Chemicals Act, the Federal Environmental Agency (UBA) is responsible for evaluating the substances registered with regard to their environmental risk.

In 2001, a total of 100 new substances were registered in Germany that are distributed to 14 areas of application (Figure 33).

Risk assessments were made for 57 of these substances, and 43 were classified as "dangerous for the environment" and must be labelled accordingly.

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

Figure 33: Number of new substances registered in 2001, broken down according to areas of application



A: Photo industry
B: Paints, varnishes, lacquers
C: Other
D: Chemicals for synthesis processes
E: Personal use and household
F: Production of polymers
G: Pulp, cardboard, paper
H: Metal extraction, refining, processing
I: Textile-processing industry
J: Agriculture
K: Production of electric and electronic devices and appliances
L: Fuel industry
M: General chemicals
N: Leather industry

The results of the risk assessments for the new substances registered in 2000 are as follows:
Conclusion I: No additional information requirement before reaching a marketing quantity of 100 tonnes per year (tpa): 41 substances
Conclusion II: Additional information/evidence of testing required after a marketing quantity of 10 tpa is reached: 9 substances
Conclusion III: Additional information/evidence of testing required immediately: 5 substances
Conclusion IV: Immediate risk-reduction measures required, contact established with registering party: 2 substances

281 new substances were registered in all the other EU member states. On the whole throughout the EU, 10 substances reached marketing level 1

(100 tpa) and four substances marketing level 2 (1,000 tpa). *(IV 1.1)*

Chemical testing versus animal protection?

In order to warrant a precautionary substance policy, both the authorities – such as UBA – and industrial companies must shape their chemicals management in such a manner that the production, use and disposal of chemicals do not constitute unacceptable risks to health and the environment. Data concerning physical/chemical properties, degradability and accumulation as well as possible effects of the substances in question forms an indispensable foundation here. Because significant risk assessment requires sufficient data, and sensible chemical management can only be designed and implemented with reliable risk assessments.

The current reshuffling of European chemical policy was also the result of the deplorable state of affairs where there were still enormous data loopholes for a vast number of widely used chemicals, particularly with regard to their degradability, accumulation and possible effects. This ultimately meant a lack of reliable risk assessments and serious shortcomings for the aspired precautionary chemical management. One important element of the new European strategy in chemical policy is hence an ambitious plan to close these data loopholes (refer also to chapter 12).

The players involved from authorities, business and a host of non-government organizations (NGOs) are currently working on shaping this plan for chemical testing in such a manner that the three ambitious targets can be reached at the same time:

- Effective protection of human health and the environment through sufficient information
- Fast and also economically efficient availability of data that is so far still lacking
- Comprehensive consideration of animal protection

In view of the ambitious plans for the coming years to identify the test data that has been lacking up to now on thousands of chemicals, an effective and global strategy for the prevention of avoidable suffering of experimental animals is becoming more important. This is the only way that political commitments concerning the enormous importance of animal protection can be also practically implemented in chemical testing.

Detailed information on animal testing, substitute and supplementary methods, also in relation to the various legal areas can be found in chapter XIV of the Federal government's Animal Protection Report 2001 (Tierschutzbericht 2001) (on the Internet at: www.verbraucherschutzministerium.de, under "Tierschutz" [Animal Protection]). Refer also to website of the Zentralstelle zur Erfassung und Bewertung von Ersatz- und Ergänzungsmethoden zum Tierversuch" (ZEBET) [Central office for the recording and evaluation of substitute and supplementary methods of animal testing] at: www.bgvv.de, under "Tierschutz/ZEBET").

With regard to test guideline programmes by the EU and OECD, also refer to: ecb.jrc.it/testing-methods and www.oecd.org/ehs/test. (IV 1.1)

Detergents and cleaning agents

Around 5,800 new detergents and cleaning agents or new compositions of existing brands were put into circulation in 2001 in Germany. This includes all products for home, commercial or industrial use which can subsequently enter the sewage system or waters and where their basic compositions must be reported to UBA pursuant to the Law on Detergents and Cleaning Agents (WRMG). This does not include hygiene products and cosmetics.

The reports gathered by UBA show that at the end of 2001 more than 57,000 detergents and cleaning agents from 3,600 companies were on the German market.

In 2001, a total of 273 companies registered with UBA for the first time as manufacturers or distributors of detergents and cleaning agents. Foreign companies accounted for around one in four of these companies.

Based on polls by the industrial association for hygiene and cleaning agents, consumption of cleaning agents in Germany in 2001 totalled around 630,000 tonnes. This is equal to an annual consumption of 7.66 kilograms per capita. Monitoring pursuant to the Law on Detergents and Cleaning Agents is the responsibility of the Federal-state authority in the Federal state where the respective manufacturers or distributors have their place of business.

Comprehensive information is available on the Internet at: www.umweltbundesamt.de, under "Daten

und Fakten" [Facts and Figures], "Wasch- und Reinigungsmittel" [Detergents and Cleaning Agents].

(IV 1.2)

Risk assessment and risk reduction for existing substances within the scope of the EU

Up to now, four priority lists have been published by the EU with a total of 141 existing substances (refer to chapter 12) in the years 1994, 1995, 1997 and 2000. The member states have prepared risk assessments for 88 of these substances and the scientific/technical discussion for 56 substances has been completed in technical meetings on EU level. Furthermore, 5 substances from the field of environment and 6 substances from the field of human health were finally discussed. 10 of the 56 risk assessments that have been completed come to the conclusion that there is no further need for action. Additional data is required for one substance before final conclusions can be drawn. There is a need for action for 45 substances, i.e. the leading member states must draft risk reduction strategies. Such strategies have already been proposed for 24 of these 45 substances. Only 11 substances have passed through the complete procedure up to the time the recommendations were published by the EU Commission. Risk reduction measures were found to be needed for 9 of these substances.

The summaries of the risk evaluations are available on the Internet at: ecb.ei.jrc.it/existing-chemicals.

UBA is responsible in Germany for the environmental part of the risk assessments and risk reduction strategies. Of the 13 substances that were finally handled and for which Germany is responsible, 7 require risk reduction measures in the environmental sector:

- Methacrylic acid
- Acrylic acid
- Methyl methacrylate
- 3,4-dichloroanilin
- Anilin
- EDTA
- NaEDTA

The discussion on risk reduction strategies for methacrylic acid, acrylic acid and methyl methacrylate are soon to be completed on EU level. The proposed risk reduction measures are related to the use of substances in soil injection agents that are often used to seal buildings (acrylic acid and methacrylic acid) as well as the use for wet polymerization in processing factories (acrylic acid and methyl methacrylate).

(IV 1.1)

Pharmaceuticals in the environmental assessment

For farmers, the year 2001 began with a bang: "All that cows need is water, beet, grass and grain, nothing else", said Renate Künast, Minister for Consumer Protection and Food Safety. Shocked by the scandals with bovine spongiforme enzephalopathy (BSE, "mad-cow disease") and antibiotics in animal feed, politicians are searching for new standards in animal production. Politicians are now relying on humane, quality-based animal farming in line with the protection of soil and water.

However, it can be expected that foodstuff-supplying animals will not just survive on "water, beet, grass and grain", but that they will also continue to receive medication when necessary for veterinary reasons. From the point of view of environmental protection, it is hence vital that traces of animal pharmaceuticals which are released into the environment after animals have received medical treatment undergo comprehensive ecotoxicological examination.

For three years now, UBA has been performing in-depth environmental examinations of animal pharmaceuticals (refer to page 171). This form of risk assessment is demanded in the *Pharmaceuticals Act (AMG)*. This is carried out on the basis of a guideline that considers the behaviour and ecotoxic effects of animal pharmaceutical residues in water and soil. A new, improved concept for this guideline is currently being prepared which will become valid for all western industrial states from 2003 onwards. For this purpose, a working group was set up on EU level in 2001 with the involvement of UBA.

The greater part of animal pharmaceuticals available on the market, however, will remain unchecked in environmental terms because pharmaceuticals which were approved prior to the inclusion of the environmental concept in the Pharmaceuticals Act in 1996 are exempt from such examination. This is why UBA proposes that analogous to the regulations for plant protection agents and existing chemicals, the environmental behaviour of existing pharmaceuticals be gradually examined.

With each new finding in soils, surface water, groundwater and drinking water, pharmaceuticals are becoming more and more the focus of public and scientific attention. Up to now, human pharmaceuticals have been primarily found in surface waters. In 2001, the European Medicines Evaluation Agency (EMEA) tabled a draft discussion paper for a guideline on the environmental assessment of pharmaceuticals for human use. UBA is of the opinion that the environmental examination of human pharmaceuticals is necessary, but that the draft must be revised in many key areas. *(IV 1.2)*

Department IV 2:

Evaluation of substances, gene technology

German or European product register?

In 2001, UBA completed a research project that compares the European and German product register for chemicals. The intention was to clarify whether such a register could serve as a useful administrative tool during the environmental assessment of chemical substances and products, whilst considering specific chemical, technical, legal and IT aspects.

The project looked into how an officially managed German and pan-EU register of chemical products would have to be designed in order to facilitate improved estimates for the exposure of the environment, consumers and workers to chemical substances. The term product includes chemical substances, preparations and – indirectly – also products.

By gathering data on the use of chemicals, applications are to be identified that constitute a risk to man and the environment. The aim of the project was to develop a concept, including technical implementation measures, in order to improve the availability of data in terms of the end use of chemicals in preparations and products. Both the proposal by the EU Commission for a new EU chemicals policy (REACh system, refer to chapter 12) as well as the experience gained with national product registration systems were included in the considerations.

Three different approaches are conceivable:

- A European network of national product registers based on a common standard for reporting and for exchanging data on the use of chemical substances
- Obligations to report for producers and importers of chemical products in as far as they contain priority existing substances
- Obligations to report imposed on users of certain substances.

These approaches do not necessarily exclude each other and should be employed in a flexible manner, depending on the speed and success of the new EU chemicals policy. Measures on national and EU level can supplement each other.

A German initiative should be designed in such a manner that it contributes towards the development and implementation of the REACh system, but at the same time also promotes practical measures on a national level.

Further development work is necessary, above all, with a view to the following:

- A harmonized system for labelling types of use
- A management system for the further-processing of substances
- Criteria for determining substances and product types where the recording of application patterns appears to be particularly important
- Effective monitoring strategies in order to restrict the use of substances to the purpose intended

This is why the Federal Ministry for the Environment (BMU) has planned another project on the product register in the 2002 Environmental Research Plant (UFOPLAN).

The study titled "Vergleichende Untersuchung verschiedener europäischer und deutscher Produkte-Register für Chemikalien als Grundlage für die bevorstehende Entscheidung über die Einrichtung eines einheitlichen deutschen oder europäischen Produkte-Registers für Chemikalien" [Comparative examination of different European and German product registers for chemicals as a basis for the pending decision on the establishment of a common German or European product register for chemicals] is available on loan under No. UBA-FB 00 290 from UBA's library (address on page 2).

(IV 2.1)

Consumption data on animal pharmaceuticals in Germany

Contrary to human pharmaceuticals that enter the environment via sewage and sewage treatment plants, animal pharmaceuticals enter the environment via the spreading of slurry/manure on agricultural land. In order to assess the exposure of the environment to animal pharmaceuticals, it is hence necessary to be aware of the extent to which animal pharmaceuticals are used in animal production.

Although veterinarians in Germany register the administration of animal pharmaceuticals – contrary to human pharmaceuticals – there is no central office that records this data. UBA has commissioned a research project in order to record the animal pharmaceuticals administered in intensive animal production. Due to the events related to bovine spongiforme enzephalopathy (BSE, "mad-cow disease"), foot-and-mouth disease (FMD) and the incorrect use of antibiotics, only 60 of the 400 veterinarians polled were willing to take part in the recording of data.

Based on the information supplied by the 60 veterinarians, Dr. Hirsch & Gayer Consulting, Rheinbreitbach/Essen, has derived trends for the three groups of substances, i.e. antibiotics, anti-parasites and other substances for Germany (Table 19).

The pharmaceuticals recorded were compared with a list of substances found in surface waters which was prepared by the Federal-government/Federal-state pharmaceuticals working group (BLAK) "AG-Arzneimittel". It was found that up to now the large quantities of animal pharmaceuticals used on animals up to now in intensive animal farming are not apparent in surface waters or that they cannot be analytically detected up to now. *(IV 2.2)*

Exposure assessment for biocides

The *EC Biocide Directive (Council Directive 98/8/EC)* divides biocides into 23 product groups depending on their application. Since the evaluation of environmental risk is to be harmonized within the European Union, standardized emission scenario documents (ESDs) are now needed.

An ESD describes the immission paths of a substance into the environment during various phases of its lifecycle, i.e. the production, formulation, production application, use and disposal. Up to now, there were still no such standardized scenarios for the majority of the 23 product types. An EU working group in which UBA was involved has completed such scenarios for five of these product types (disinfectants in the health sector, biocides in the paper production industry, the leather and textiles industry, for embalming (human corpses) and taxidermy (preparation of animals). The working group plans to prepare further ESDs in 2002 and 2003.

Table 19: Annual consumption of animal pharmaceuticals in Germany

Substance group	*Total consumption (kilograms/year)*	*Animal*	*Consumption [%]*
Antibiotics (41 active ingredients)	*2,126,691*	*Pigs*	*67.6*
		Cattle	*31.8*
		Sheep	*0.1*
		Poultry	*0.5*
Anti-parasitic agents (14 active ingredients)	*21,764*	*Pigs*	*73.5*
		Cattle	*14.3*
		Sheep	*11.7*
		Poultry	*0.5*
Other active substances (19 active substances)	*169,933*	*Pigs*	*77.3*
		Cattle	*22.1*
		Sheep	*0.2*
		Poultry	*0.3*

Source: Report "In Deutschland eingesetzte Tierarzneimittel inklusive der Verbrauchsdaten" [Animal pharmaceuticals used in Germany, including consumption data], UBA, 2001

On behalf of UBA, Institut Fresenius in Taunusstein prepared a report on the industrial and commercial use of wood preservatives in Germany. The result of this report is a contribution to the ESD within the scope of the OECD's biocide programme. The aim of this programme is to prepare co-ordinated ESDs for various methods of application for wood preservatives as well as the installation of treated wood in various areas – such as soils or water. The document is currently in the OECD approval procedure.

Besides ESDs, another key element of estimating exposure of the environment to wood preservatives is knowing the emission rates for substances from treated wood throughout its often very long service life. Volatility and leaching are considered to be relevant aspects. With a view to this, UBA has commissioned a research project (refer to page 174).

The scenarios are available on the server of the European Chemicals Bureau (ECB) at: ecb.jrc.it.
(IV 2.2)

Substance data on atmospheric degradability

Under high steam pressure and in a gaseous state, chemical substances can drift far in the atmosphere. Even in the case of less volatile substances, it is possible that they can be transported long distances through the air; i.e. attached to dust particles and in aerosols. This is a particular problem in the case of persistent organic pollutants (POPs, refer to chapter 12). During transport, however, these substances can also be degraded, particularly through photochemical processes. OH radicals that are formed in the atmosphere are particularly efficient here. The efficiency with which these photo-oxidative processes take place also directly determines a substance's potential for long-distance transport. Up to now, however, it was extremely difficult to measure the photo-oxidative degradation of a substance, particularly in an adsorbed state.

At the second UBA expert talks on "Persistence and long-distance transport potential" in September 2001, the first results of a research project on behalf of UBA were presented in which new approaches for measuring photo-oxidative degradation on surfaces are to be developed. Besides measuring degradation, the formation of degradation products can also be tracked. The project carried out by Prof. Rühl, Universität Osnabrück, and Prof. Zetzsch, Fraunhofer Institute of Toxicology and Aerosol Research, Hannover, is targeted towards experimental testing methods that are to be harmonised on an international level.

The report titled "Fachgespräche über Persistenz und Ferntransport von POP-Stoffe" [Expert talks on persistence and long-distance transport of POP substances] (TEXTE 16/02) is available from Werbung + Vertrieb (box on page 167). *(IV 2.2)*

Biodegradation of pharmaceuticals

Pharmaceuticals are used in Germany in enormous quantities in both human and veterinary medicine. Following their use, they are released, sometimes unchanged or as metabolites, and can then directly enter the sewage system or the soil in animal faeces (sewage sludge, dung) spread on agricultural land. In terms of their quantity and effect, antibiotics play a particularly important role. Parasite control agents, hormones, anti-inflammatory agents and other animal medicines are also used in significant quantities. Evidence of concentrations of animal pharmaceutical residues have been found in soils. They can enter surface waters and groundwater via run-off and leaching. This means that pharmaceuticals and their residues can enter drinking water.

The concern that soils and groundwater can be impaired by pharmaceuticals – in particular by those used in intensive animal farming – has not been fully allayed by the results of research up to now. This is why it is now necessary that an in-depth risk assessment be used focussing on the biological degradation, leaching behaviour and ecotoxicological effects of certain animal pharmaceuticals.

UBA has commissioned a number of different research projects on this issue. These are at to be carried out by the Landwirtschaftskammer Weser-Ems [Weser-Ems Chamber of Agriculture] in Oldenburg; the Forschungs- und Studienzentrum für Veredlungswirtschaft Weser-Ems [Research and study centre for processing Weser-Ems] at Universität Göttingen in Vechta and the Fraunhofer Institute for Molecular Biology and Applied Ecology in Schmallenberg. First results have already been supplied showing that only slight biological degradation can be found in the environment for the largest substance group of tetracylines (antibiotics). Further conclusions from the research projects will not be possible until after the pro-

jects have been completed. The aim of these projects is also to prepare a specific soil test that considers resistance build up, accumulation effects, toxic impacts on soil micro-organisms and the leaching behaviour of these substances. *(IV 2.3)*

Effects of plant protection agents on non-target plants

From the point of view of environmental protection, the effects of plant protection agents on the environment can be classified as unacceptable if the sustainable influence on abiotic (inanimate) elements, communities or physiological functions cannot be ruled out with sufficient reliability. In order to identify the impacts of plant protection agents on non-target plants, the effects of the agents must be examined on at least six different types of plants within the scope of the plant-protection-agent approval procedure.

The ecotoxicological tests are performed as single-species tests under laboratory and greenhouse conditions, in standardised artificial systems as microcosm and mesocosm tests or in real systems under open air conditions. The results of single-species tests under laboratory or greenhouse conditions, however, can hardly be applied to open air conditions. Much the same can also be said for field releases, because numerous parameters which may influence results are subject to unforeseeable fluctuations, or cannot be recognised and documented. This means that strictly speaking it is hence not possible to repeat such tests. Furthermore, field releases are also unlikely to identify the herbicidal effects on bordering vegetation – for example, on field borders – because these have often already been exposed to herbicides.

A report by Universität Gießen proposes several years of testing on plants with experimental microcosms and mesocosm, i.e. with standardised artificial systems, as a suitable and probably more reliable testing method. These systems must be temporarily exposed to various concentrations and when possible combinations of different plant protection agents under open air conditions. Then, under controlled conditions, the effects of the plant protection agents on elements, communities and functions in the hierarchy levels of the system must be analysed. Such systems would bridge the gap between simple laboratory systems and very complex open air situations. *(IV 2.4)*

Risk assessment of transgenic woody plants

In face of the world-wide increase in the number of release experiments with genetically modified trees and their growing commercialization, it is important that research work in this field be promoted. On the one hand, there is very little information available on the behaviour of transgenic trees in the environment and on the other hand, trees are particularly important for the environment due to their long life and their various forms of interaction in ecosystems.

The aim of a three-year joint project by UBA and the Schlewig-Holstein Ministry for the Environment, Nature and Forestry is to improve the foundations for risk assessments for the release and putting on the market (market approval) of genetically modified woody plants. This comprehensive research project focuses on issues of permanent expression of the new property (stability of the foreign gene), cross-breeding of related species as well the risk posed by the spread of transgenic woody plants in the environment.

Using poplar trees, larch trees, rhododendrons and roses, experiments will be carried out to asses the influence of stress factors on transgenic expression. The stability of the transgenic expression may be of enormous importance in terms of safety if this expression is sterility, i.e. a biological safety measure designed to prevent transgenic trees from multiplying and spreading. At least in the case of woodland trees, only sterile plants should be able to enter the environment. *(IV 2.5)*

The probability of the cross-breeding of transgenes under open air conditions is to be determined on an exemplary basis for the ornamental rhododendron plant using micro-satellite methods (on non-transgenic plants). A mathematical model will be developed for the spreading of transgenes in the environment via pollen and seeds. The research project will be completed by a round of expert talks in 2004.

Intermediate results are available on the Internet at: www.umwelt.schleswig-holstein.de and at: www.umweltbundesamt.de. The first partial study titled "Stabilität transgen-vermittelter Merkmale in gentechnisch veränderten Pflanzen mit dem Schwerpunkt transgene Gehölzarten und Sterilitätsgene" [Stability of transgenically expressed genes in genetically modified plants focusing on transgenic woody plants and

sterility genes] will be published in 2002 in the TEXTE series and available from Werbung + Vertrieb (box on page 167). *(IV 2.5)*

Wood preservatives: Is the voluntary agreement enough?

Voluntary agreements and obligations are increasingly becoming an important instrument of environmental policy. Germany's chemical industry, for example, has already entered over 30 voluntary agreements. Although, voluntary agreements are quite controversial. On the one hand, voluntary agreements are often criticised from the point of view of regulatory measures, on the other hand, the advantages of such voluntary agreements are pointed out – such as flexibility and cost efficiency.

Pursuant to the voluntary agreement by industry on preservatives to combat wood-destroying and/or wood-discolouring organisms of 10 October 1997, a registration and evaluation office for blue-stain protection agents (for wood preservatives that combat wood-discolouring organisms) was set up at UBA.

Based on this voluntary agreement, in 1998, the VDL's (Association of German Paint Manufacturers) technical working group for building paints, working group 6 on Blue-stain protection/wood protection drafted a guideline together with the authorities involved (Federal Institute for Materials Research and Testing, BAM and the Federal Institute for Health Protection of Consumers and Veterinary Medicine, BgVV and UBA). This *VDL guideline on blue-stain protection agents (VDL-R 05)* is particularly designed to show manufacturers and formulators of blue-strain preservatives what is needed for voluntary registration in Germany. Pursuant to the voluntary agreement, this voluntary registration is valid for blue-stain protection agents as part of a coating system. This includes prime coats and impregnating coats that are used to treat wood for outdoors.

The registration of blue-stain protection agents is contingent upon confirmation of their biological efficiency in the form of a BAM report, as well as a health-related evaluation by BgVV and an environmental assessment by UBA.

A simplified approval procedure – also foreseen in the *EU Biocide Directive (Directive 98/8/EC)* for the registration of so-called biocide products with a low risk potential and the definition of framework formulations – was adopted and tested in this procedure.

In the four years since the signing of this voluntary agreement, UBA has received a total of 328 applications for wood preservatives with quality labels within the scope of the RAL procedure (RAL: German Quality Assurance Institute). In the VdL registration procedure, on the other hand, 23 applications for blue-stain preservatives as part of a coating system, as well as 13 basic compositions and 2 single compositions were received. More than twice the number of applications for blue-stain preservatives are assigned to the RAL procedure than to the VdL procedure.

Despite the voluntary agreement, the share of uncontrolled wood preservatives (grey market) still accounts for a significant market share particularly among consumer products. Unfortunately, there are still very few RAL/VdL products to be found in the consumer goods sector. Although wholesalers and retailers were already requested in 1998 to enter the voluntary agreement with the manufacturers' association or to reach a consensus on a voluntary agreement with the same aims, the efforts for greater environmental and consumer protection are still not receiving sufficient support. According to information from manufacturers of wood preservatives, they sell their checked products primarily to specialist dealers.

It is still difficult to understand why checked agents are unable to enter the retail sector to a sufficient extent. From UBA's point of view, it is the task of the associations involved to call on their members to abide by the voluntary agreement.

The voluntary agreement is a temporary measure until the provisions of the EU Biocide Directive comes into effect. This contains a statutory approval procedure, also for wood preservatives, so that the "grey market" of unchecked agents that currently exists will disappear. *(IV L)*

Risks of wood preservatives

The *EU Biocide Directive* states that in future all biocide products within the European Union will require approval. This is only possible if the use of these products has no adverse effects on man and the environment. Starting with wood preservatives in 2004, all substances already on the market will undergo risk assessment.

Wood structures installed in the ground or that come into contact with water, or which are exposed to rainfall, are normally treated with wood preservatives in our regions in order to protect them against insects and decay. During the course of time, parts of these substances escape from the wood and enter the environment. Since wood protection is designed to act for as long as possible, the substances are not only ecotoxic, but are also usually slow to decompose. This means that these substances can accumulate in the soil or in sediments in waters.

In order to assess the risk which this bears, there is one primary question: Which quantity is washed out per time and area unit? The answer depends not only on the type of substance (organic, inorganic) and the immission path, but also on other influence variables, such as number, duration and intensity of rainfall, or the type of wood. This then provides different wash-out profiles. Open-air tests are not suitable for this – not just because weather conditions cannot be standardised, but also because of the time-related effort which the assessment involves. One elementary precondition so that the results of wash-out tests with various products and from various laboratories can be compared at all is a laboratory test procedure that is standardized to the maximum extent possible.

This is why UBA commissioned the Federal Institute for Materials Research and Testing (BAM) to develop such a test procedure and to check the impacts of different test conditions on the result. The heart of the project involved the preparation of a general framework test procedure valid for various materials (wood, brickwork, foil, paint coats); furthermore, the study offers instructions for the respective matrices.

The project was concluded in December 2001. The results are directly integrated into the Test Guideline Programme of the Organization for Economic Co-operation and Development (OECD). This hence warrants acceptance of the test results in the other OECD countries.

The study titled "Untersuchungen zu Austragsraten von bioziden Wirkstoffen aus behandelten Materialien" [Examination of the wash-out rates of biocide substances from treated materials] is available on loan under No. FKZ 299 67 410 from UBA's library (address on page 2). *(IV L)*

Ban on tributyl tin in ship paint

Following long and difficult negotiations in October 2001, the members states of the International Maritime Organization (IMO) have agreed to a convention that foresees a global ban on organotin in antifouling paints used on ships as of 1 January 2002. As from January 2008, old paint on ships containing organotin is to be either removed from the hulls or they are to be sealed with a special coat (sealer). In order to come into effect, this convention must be signed and ratified by at least 25 nations under whose flags at least one quarter of the gross tonnage of the world's trade fleet is unified. The convention will then come into effect 12 months later.

A resolution calls on the member states to adhere to the convention's deadlines for the ban, even if the convention should fail to come into effect by that date. Germany – just like the other EU states – is determined to achieve quick ratification. In December 2001, the EU Commission tabled a first draft directive for the amendment of the *EU Restrictive Directive (Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations).* *(IV L)*

Central Administrative Division

Department Z 1:

Administration and project supervision

Staff

The number of jobs at the Federal Environmental Agency (UBA) fell compared to 2000 by 1.4 % to 1,001 at the end of 2001 (Table 20). Compare this to: employment in 1994 still totalled 1,099 jobs.

Table 20: Permanent jobs/other jobs (budget)

Year	Total	Civil servants	White collar	Blue collar
1998	1,043	476	490	77
1999	1,032	397	556	79
2000	1,015	390	549	76
2001	1,001	387	538	76

On the whole, UBA employed 1,241 people. Like in previous years, the number of women increased further. Table 21 shows the share of women and men in the different professional and salary groups.

(Z 1.1, Z 1.3)

Training

In 2001, a total of twelve school leavers were trained as "Administrative Clerks" at UBA. Four new trainees were taken on. Training primarily took place in the Central Administrative Division. In addition, ten "Chemical laboratory technician" trainees were trained in the department units. Furthermore, 20 junior lawyers and 73 university trainees together with seven young people who had finished their "Voluntary Ecological Year" were given the opportunity to train at our administration or to gain practical experience at UBA. Three short-term trainees, five pre-graduates, six scholarship recipients and 21 school trainees were also welcomed by the Agency.

(Z 1.1)

Budget

In 2001, UBA had a budget of around 84 million euro (DM 165 million) (Table 22, figures in 1,000 DM). The decline against 2000 is due to the fact that investment in construction projects was adapted to the updated time schedule.

(Z 1.2)

Introduction of cost and performance accounting

The introduction of cost and performance accounting marks an important step in the modernisation of UBA. The aim here is to achieve greater transparency for costs and performance and to provide a more sound foundation for the planning and control procedures currently used at UBA. At the same time, the information provided by this system of cost and performance accounting is to support the system for budget planning and implementation.

Table 21: Share of female and male employees

Professional group	Total number	Female	Male
Senior (management)	146	22	124
Upper level	336	150	186
Higher level	318	180	138
Standard level	347	273	74
Lower level/ blue-collar workers	94	33	61
Total	**1,241**	**658**	**583**

Table 22: The Federal Environmental Agency's budgets for 2000 and 2001 (in thousand DM)

	2000 budget DM×1,000	*2001 budget DM×1,000*
I. Umweltbundesamt budget		
I.1 Total expenditure	***169,916***	***165,590***
Of which		
– Personnel	*98,105*	*99,634*
– Investment	*38,578*	*33,116*
– Costs of scientific publications and documentation	*563*	*563*
– UMPLIS environment information and documentation system	*4,681*	*4,681*
– Data processing costs	*5,759*	*5,759*
I.2 Contract work for Federal authorities and third parties		
– Federal authorities	*2,359*	*2,430*
– EU, other	*4,748*	*4,400*
II. Funds held in trust for various purposes, including:		
– Investment in projects for reducing environmental burdens	*7,505*	*9,666*
– Research projects (UFOPLAN)	*49,800*	*44,260*
– Environmental Specimen Bank	*6,770*	*8,000*
– Subsidies and grants to associations of all kinds		
• Institutional promotion	*3,583*	*3,502*
• Project support	*9,147*	*9,360*
– Education measures	*2,833*	*2,340*
– Consultancy support in the successor states to the former Soviet Union, as well as central and eastern European countries	*518*	*0*
– Consultancy assistance for environmental protection in the central and eastern European countries as well as in the New Independent States (NIS)	*2,351*	*2,560*
– International co-operation	*1,042*	*965*
Total funds held in trust	***83,549***	***80,653***

Now that the concept for cost and performance accounting, which was developed by UBA together with a consultancy firm, has been tested using software-based prototypes, key cornerstones are available for the final concept. Intranet-based recording of time and quantity data at the workplace will reduce the efforts required for this work. The recording of quantities at the workplace (for example, the number of applications processed) is foreseen for a later point in time. An existing online recording system will be enhanced for this purpose.

Work with the prototypes also showed that it is possible and makes sense to optimize the UBA product catalogue in terms of relevance, precision and completeness. For example, the number of products recorded by UBA was reduced to around 300. The important performance monitoring part for UBA as a Federal scientific agency will commence at the end of the time recording phase at the end of 2002.

All employees took part in preparatory training in cost and performance accounting and IT. Following the conclusion of a service agreement on cost and performance accounting/time recording between UBA and the Central Works Council, the working hours spent have been recorded in all the specialist departments and the Central Administrative Division since 15 October 2001. In order to respond to queries, capacities were made available in the cost-and-performance-accounting project team (KLR team), at the same time, the intranet is open for all employees in order to exchange information.

The further expansion of cost and performance accounting will progress in several stages, whilst precision will increase in line with the integration of cost

causers. The optimization of cost and performance accounting is seen as a continuous process where the integration of cost data from other administration systems constitutes an important step forward towards the allocation of costs on a cause basis. The following further steps are planned:

- Elaboration of reporting (cost and performance reports)
- Completion of documentation (manuals, product catalogue, etc.)
- Concept for the integration of relevant cost-and-performance accounting data from other IT systems in UBA's administration (interface concept)
- Revision of performance accounting (boosting cause justness)
- Definition of change requirements for the software systems

(ZL, KLR team)

Department Z 2:

Documentation, data processing and IT user service

Environmental information systems in the Middle East

The co-operation that was initiated in recent years with Syria, the Lebanon and Jordan has been intensified. Within the scope of a research project, a concept for a regional environmental information system is to be prepared by 2003. The project bears the title: Regional Information System for the Environment (RISE). The State Ministry for the Environment in Syria, the Lebanon's Environmental Ministry and Jordan's Environmental Authority are taking part in this project.

The first phase of the project involves viewing and systematically cataloguing existing data stocks. This work will be carried out using the CDS software that was developed by the European Environment Agency (EEA) with the assistance of the German European Topic Centre Catalogue of Data Sources. An Arabic version of the software is currently being prepared and data recording (development of an Arabic thesaurus, regional classification) is being prepared. This will be followed by the polling of so-called meta information in co-operation with local contractors and the ministries. The completion of this first campaign will provide an overview of existing environmental data stocks.

Using these results, a generic concept for an environmental information system must be developed. "Generic" should be understood as follows: rather than developing a specific system for each country, a common system concept is to be developed with country-specific adaptations. Furthermore, the concept is to secure regional co-operation. *(Z 2.1)*

Geographical Information System for the Environment (GISU)

The Geographical Information System for the Environment (GISU) is part of the information offered by UBA. GISU is currently available as a test installation on the Internet and offers users a comprehensive research and reference system via the geo-data pool. Within the scope of the use of GISU on a permanent basis, redesign measures are needed in order to meet with quality and quantity requirements. The new concept pursues the following objectives:

- Adaptation of the application to state-of-the-art IT applications whilst considering the existing software and hardware environment at UBA
- Substituting old software products and hence the related programming languages
- Improving the response time behaviour, above all for research
- Clear operation
- Improved security for the application

Based on an architecture concept, the following results were achieved in 2001:

- Storage of meta data in an object-relational database (ORACLE)
- Implementation of a new user interface based on Java as the programming language
- Storage of geometry data using the ArcIMS and ArcSDE software products

The further expansion of GISU to an information system designed for permanent operation requires the migration of the data stock, the adaptation of the interfaces with other information systems – such as, for example, with the Geo MIS Bund and with GEIN. Following completion of these further developments, GISU will be used as an internal tool for the processing and management of geo data.

(Z 2.4)

Hazardous Substance Quick Information Service

The Hazardous Substance Quick Information Service (GSA) has been in operation at UBA since December 1989 as a predecessor to the Joint Substance Data Pool of the Federal-government/Federal-states (GSBL, refer to the 2000 Annual Report). 103 external online users are currently registered, including public and municipal environmental offices, as well as fire brigade headquarters. In November 2001, the new GSA (GSA 2) began trial operations. This application is web-based and was jointly developed with the research interfaces of the GSBL. The data stock is a special selection taken from the data of the GSBL. Whilst GSA 1 contains information on around 8,600 substances, GSA 2 contains information on a good 30,000 substances. Part of the GSA data can be researched on the Internet via GEIN. In 2001, around 2,100 substance queries were submitted to and processed by GSA. *(Z 2.4)*

Environmental literature and environmental research database

For some years now, UBA has been operating the ULIDAT environmental literature database and the UFORDAT environmental research database. These central databases are available to the public online, on CD-ROM and on the Internet at: (http://isis.uba.de:3001). The data contents once again grew substantially in 2001 – especially due to the intense analysis of Internet offers by researching institutions (Table 23). *(Z 2.5)*

Renewed certification of the quality management system

Several of UBA's information systems have been managed since 1997 under a quality system (Q system) that is certified pursuant to the ISO 9002 standard: the environmental literature database (ULIDAT), the environmental research database (UFORDAT), the environmental information system (URIS/URA) of Erich Schmidt Verlag (in the case of URIS/URA, this is a successor system to the environmental legislation databases, URDB, that is operated as a private/public partnership), the information exchange office at Unit Z 2.5 and the products generated from the databases. The quality management manual forms the basis for the Q system. This manual describes the Q systems in compliance with the quality policy defined. This was certified once again in May 2001 by EQ-Zert, Ulm. This success is further motivation for UBA to continue pursuing this route towards a user-orientated offer. The Agency is convinced that institutionalised quality management means continuous "pressure to improve" the quality of the databases and the information products. The continuous improvement of the aforementioned products for users by optimising the Q system itself is hence a central task.

The environmental research database UFORDAT is available on the Internet at: isis.uba.de:3001, URIS/UBA at: www.umweltonline.de. (Z 2.5)

Table 23: Development of the ULIDAT and UFORDAT databases

Database	*Inventory (Data sets)*	*Growth in 2001 (Data sets)*
ULIDAT	*430,000*	*30,000*
UFORDAT	*69,000*	*4,000*

International co-operation

Within the scope of co-operation between the Austrian and German Federal Environmental Agency on the environmental data catalogue, a new edition of the CD-ROM thesaurus was prepared which features the new version (in English and German) of the UDK thesaurus (which corresponds to the UBA thesaurus) as well as the latest edition of GEMET (the General European Multilingual Environment Thesaurus of the European Environment Agency) in 15 languages. Furthermore, ENVOC, the multilingual thesaurus of environmental terms from UNEP/INFOTERRA in six UN languages, the waste management thesaurus from the Austrian standards institute and the encyclopaedia of forest-endangering air pollutants from Forstliche Bundesversuchsanstalt (Forestry Research Institute) in Vienna were saved.

The co-operation partners UBA Berlin and UBA Vienna have commissioned together with CNR (Consiglio Nazionale delle Ricerche) in Rome the development of the new administration software thesaurus which enables convenient thesaurus development and updating – also beyond the scope of the environmental sector – and which can be easily integrated into existing systems.

The thesaurus CD can be ordered on the Internet via UBA Vienna at: www.cedar.at/wgr_home/. (Z 2.5)

Specialist library for the environment

The specialist library for the environment is a service for the Agency's staff and for the interested public in Germany and abroad. It is open to visitors in Berlin at the building located at Bismarckplatz and Corrensplatz as well as the Bad Elster branch during regular working hours.

In 2001, the library increased its inventory by 7,000 volumes to around 374,000. Around 1,000 magazines are subscribed on all fields related to the environment. Online access to magazines was expanded significantly in 2001. At present, the UBA has full-text access to 104 magazines in electronic formats.

Around 24,000 users accessed the library's services and 31,000 monographs were taken out on loan. The user file contains the names of 10,000 external users. The number of uses of magazines by UBA staff totalled 65,000. The comprehensive exchange of material, for example, with around 450 exchange partners in Federal authorities, Federal State institutions and scientific organizations in Germany and abroad ensures that the library is kept up to date.

Environmental reports and declarations are now a strongly growing sector. These publications by the Federal government, Federal states, municipalities and business have been continuously collected by UBA's specialist library. The first environmental reports date back to 1973 and 1974. Whilst the collection was initially strongly orientated towards the Federal government and Federal states, i.e. more nationally orientated and with a focus on environmental reports, since the introduction of EMAS (the EU's Eco-Management and Audit Scheme which was introduced in 1993 and which has been implemented in Germany since 1996), environmental declarations are now being increasingly gathered from industry (refer also to page 100).

The stock of environmental reports and declarations has now grown to around 5,000 copies. UBA's specialist library is hence the most comprehensive of its kind in this respect.

An Internet database is currently being set up in co-operation with the British Next Step Consulting, London, also using data from the catalogue of UBA's Environment specialist library. This provides information concerning the location of environmental reports and environmental declarations worldwide and offers these – when available – also as PDF full text files.

The Directory of environmental and social reports can be found on the Internet at: http://www.corporateregister.com. *(Z 2.6)*

Library and EDP

The aDIS/BMS library management system, which was developed using aDIS software, supports the most important library functions: It permits the smooth handling of literature and magazine stocks.

The BIBLIODAT library database provides not just the monthly lists of new titles but also 23 selection bibliographies on such subjects as ecobalances, environmental policy and sustainable development. This information is available in printed format or online on the intranet or Internet.

Due to enormous demand, the selection bibliography "Sustainability and Environmental Communication" has turned out to be the "Bibliography of the Year".

Besides the online library catalogue (OPAC), users have access to additional research PCs where the ULIDAT environmental literature database as well as selected CD-ROM databases in the Agency's computer centre can be accessed in so-called simple dialogue. *(Z 2.6)*

New building in Dessau

New building in Dessau

With the handing over of the renovated Wörlitz railway station in October 2000, UBA moved into its first office building in Dessau (refer to the 2000 Annual Report). Whilst this marked the first steps towards a permanently visible presence on the part of UBA in Dessau, the work carried out meanwhile on the new UBA headquarters can no longer be overlooked. Following approval of the so-called Building budget document by the Federal ministries in charge (Building, Environment and Finance), the central precondition for further planning was fulfilled and execution planning could begin and other decisions were initiated.

For example, the wood facade can be implemented without a facade sprinkler system now that the Dessau government has approved the fire protection concept. This is the go-ahead for a facade variant which is seen as the most beneficial from the point of view of sustainable building.

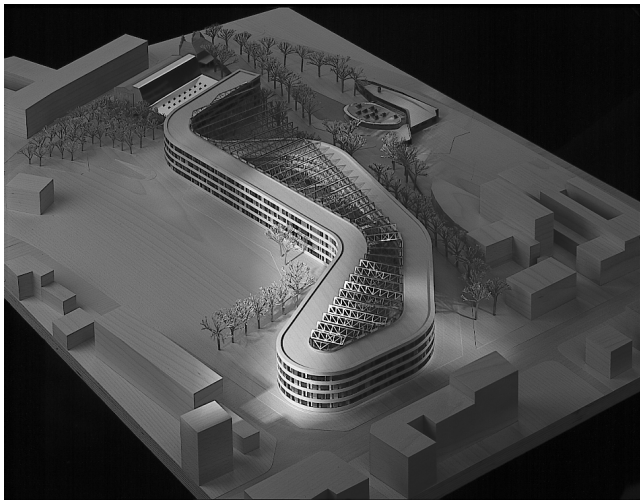
The staff at the Dessau-Wörlitzer-Eisenbahn-Verein [Dessau-Wörlitz rail association] have removed the engine shed that was unsuitable for use as a canteen. This will be re-assembled at another location at a later point in time. This measure helped to create jobs.

At the same time, the horse chestnut trees that bordered the footpaths and bicycle paths on the property had to be chopped down – there was no reasonable alternative possible (to keep them or to move them to a different location). Apart from the compensatory measures required under nature conservation legislation, new trees were also planted on a neighbouring site. Within the scope of a "tree action" by the concept artist Samuel J. Fleiner, the trees were given wishes from the citizens in the neighbourhood, in the city of Dessau and UBA staff.

The Agency wants to keep noise at the building site as low as possible. Before building began, people living in the near vicinity were informed at a meeting in June 2001 of the schedule for building measures and of the noise effects to be expected. The measures discussed at this meeting, i.e. how to reduce certain annoying effects, are to be implemented as far as possible. These aspects are continuously being dealt with by a dedicated working group in which people living in the neighbourhood are also represented.

Besides the implementation of the building as an ecological model project, this building is also to be designed in an exemplary manner with a view to the needs of the handicapped. In order to be able to fulfil these requirements which go beyond what is legally required, the Federal state of Saxony-Anhalt has agreed to cover the resultant additional costs. The Federal-state Minister for Social Affairs, Gerlinde Kuppe, handed over the subsidy notice in person to UBA vice president Dr. Kurt Schmidt in November 2001.

In spring 2002, construction work began, the foundation stone was laid on 10 April 2002. The building shell will be completed in spring 2003 and the entire building project in autumn 2004. *(Z 1.5)*



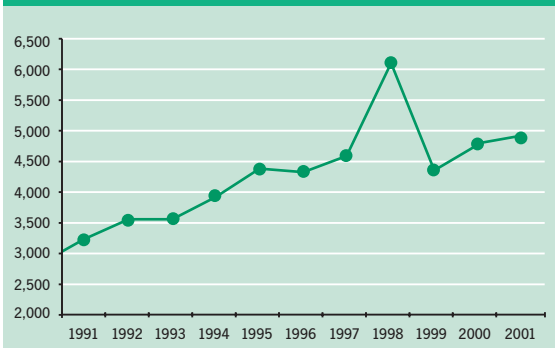
In the making: model of UBA's new building in Dessau. (photo: courtesy of sauerbruch hutton architects)

President's Office/Press Office

The Federal Environmental Agency (UBA) once again aroused considerable media interest in 2001 with the "traditional" topics of transport (for example, the HGV toll, diesel soot, bicycle traffic) and energy (renewable energy sources, saving electricity). There is a strong demand for consumer-near, almost directly perceivable topics, such as the outstanding response to the phenomena of "black flats" (refer to page 118). The discussion on can deposits also brought UBA often into media focus.

"Infection protection", "Children's health" and "Environmental and consumer protection" were three main topics of the further-education event for the public health service. This event is jointly organized by UBA together with the press offices of the Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV), Robert Koch-Institut (RKI), Paul-Ehrlich-Institut (PEI) and the Federal Institute for Pharmaceutical and Medicinal Products (BfArM). The Federal Centre for Health Education (BzgA) is also involved.

Figure 35: Press contacts from 1991 to 2001



In 2001, the Press Office received around 4,950 written (post, fax, e-mail) and telephone queries. This marks an increase by 150 against 4,800 in 2000 (Figure 35). UBA staff were interviewed on radio and TV 260 times (2000: 310). This does not include a host of interviews and short contributions in the print media.

On the panel (l to r): Klaus Wilmsen, Dr. Isolde Piechotowski, Prof. Dr. Heiko Steffens, Vera Gäde-Butzlaff, Prof. Dr. Andreas Troge. (photo: UBA/Simon)

A total of 124 press releases were issued by post, fax and e-mail (2000: 99). All press releases are currently available on the Internet at: (www.umweltbundesamt.de, under "Press Releases").

(PB/Press Office)

5. Dessauer talks: How much precaution suits us and at what cost?

The field of tension: "environmental protection, health protection, consumer protection" was the focus of the 5th round of Dessauer Talks which were held on 22 February 2002. Due to the terror attacks in the US, UBA had originally cancelled the date in September 2001. UBA president Troge who chaired the talks in Dessau's Sparkasse hit the nail on the head: "We need something to prove that precaution is vital". In other words: The public – and the public sector – will only see how important this is when it fails.

Dr. Isolde Piechotowski, Head of the Department of Health Protection at the Ministry of Health in the Federal-state of Baden-Württemberg pointed out that the principles of preventive health protection contradicted the concept of circulation. Substance recycling was not the answer to everything, as the BSE crisis and the difficulties with sewage sludge recycling demonstrated.

Do consumers have enough knowledge at all in order to be able to consciously opt for health products and foodstuffs? Prof. Dr. Heiko Steffens from the board of the consumer associations working group referred to the consumer as a "non-specialized eccentric being". Klaus Willms, Environmental and Quality Officer at Karstadt AG refused to accept this for his customers: "If the message is brought across correctly, then it will be accepted."

Vera Gäde-Butzlaff, Permanent Secretary of State in the Saxony-Anhalt Ministry of the Environment, was cautious in her reply to the question as to whether self-control on the part of producers actually worked as a result of a certain self-interest. The state could only set certain boundary conditions. And nationwide controls were simply not possible. "It is important to control the controls" and that meant here more state.

The audience responded particularly sceptical to this. One participant pointed out that there had been too few foodstuff controls and official veterinarians in Germany for years now – and the numbers were falling still.

The Dessauer Talks mark the move by UBA to draw environmental policy discussions to its future headquarters.