

# Environment Report

1997

Environmental Protection, Safety and Health in the Henkel Group



## More objectives, more topics, more data

This 1996 Environment Report is Henkel's sixth. From year to year, the topics covered have become more international, and a greater scope of material has been provided.

This year, we have included much more information about the Henkel Group as a whole, both in the data section and the text. The data have been gathered from 52 sites all over the world (last year, the number was 31) and are therefore truly representative of the entire Henkel Group. For the first time, we have included information on the Group's emissions in wastewater and on the waste situation.

Henkel companies in Turkey, South Africa, Indonesia, Australia and Argentina are represented for the first time, with reports on the progress they have made in environmental matters.

Another novum: the brochure has been given a subtitle, "Environmental Protection, Safety and Health in the Henkel Group."

Aspects of occupational safety and consumer protection were considered to be outside the scope of previous reports. Henkel's commitment to the Responsible Care Program of the chemical industry has broadened the spectrum of topics, however, especially in view of the fact that the Group-wide management system SHE (Safety, Health, Environment) is currently being introduced. SHE covers all areas of Responsible Care and includes mandatory specifications for each Group site.

The chart showing the environmental objectives of the Henkel Group and the management sectors as a whole, as well as those of the individual Group companies and production sites, has also been expanded. It demonstrates very clearly that the comprehensive and open reports on environmental subjects in recent years have motivated and stimulated the entire Group.

Because the Responsible Care management system also involves a commitment to applying internationally recognized standards, we are participating in the Eco Management and Audit Scheme of the European Union and subjecting the environmental management systems of the individual sites to

inspection and certification by accredited external verifiers. After extensive preliminary work, the first three sites were certified in 1996: the Group's largest, and especially complex, site in Düsseldorf-Holthausen; Kepec Chemische Fabrik in Siegburg; and Collardin in Herborn-Schönbach. We have set ourselves the objective of progressively achieving certification of all production sites under the EU Eco Management and Audit Scheme and/or to ISO 14001.

On the basis of this participation in the EU Eco Management and Audit Scheme, the certified sites issue a comprehensive and detailed environmental statement. This makes the distinction between the Group Environment Report and the information about individual sites especially clear. For this reason, the data section of the 1996 Group Environment Report no longer contains any data referring specifically to the Düsseldorf-Holthausen site. Some of the more interesting data items from individual sites are included in the main body of the text.



Dr. Wilfried Umbach

A handwritten signature in blue ink, appearing to read "W. Umbach".

Dr. Wilfried Umbach  
Executive Vice President  
Research/Technology



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Dialogue with the public

**Open house attracts neighbors**

The chemical industry in a dialogue with the public. Open houses at nine sites in Germany, France and the USA attracted dense crowds of visitors, who used the opportunity to obtain information on production conditions and products. For Henkel, dialogue with its neighbors is an important aspect of Responsible Care. . . . . 7, 12



Help for Philippine coconut farmers

**Capable cooperators**

Philippine coconut farmers are becoming small-scale entrepreneurs. They are establishing cooperatives, and the German Agency for Technical and Economic Cooperation (GTZ), the Philippine Coconut Authority, and Henkel are helping them to help themselves. They are supporting the building of copra dryers, for example. . . . . 14

Cosmetic products made from shrimps

**All in the shell**

High quality from the deep: Henkel's Care Chemicals section has developed active ingredients from the chitinous shells of shrimps for use in cosmetics and pharmaceuticals. The chitosan derived from chitin is characterized by its excellent ecological and toxicological properties. The strengthening effects of chitosan solutions for hair-styling products are tested on hair strands. . . . . 17



Renewable raw materials

**Opportunities for the chemical industry**

Nature at its purest – Henkel's researchers and product developers have relied on renewable raw materials for years. Their use helps to conserve non-renewable resources. . . . . 18



Product stewardship

**In view of tomorrow**

A responsible attitude is needed toward all health, safety and environmental aspects of a product throughout its life cycle, i.e., "from the cradle to the grave." Using detergents and household cleansers as an example, it is shown that significant environmental benefits can be realized during every phase of this cycle. . . . . 20



Around the globe

**Many steps toward the same goal**

Technology transfer and a lively exchange of experience between sites – throughout the Henkel Group, managers and employees work continuously to enhance the Company's environmental, health and safety protection performance. Numerous examples illustrate what is currently being achieved at the production level and show how creativity produces smart solutions. . . . . 26



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Employee motivation

**Joint environmental effort**

A special campaign on World Environment Day – On June 5, 1996, employees of the Henkel South Africa Group at Alrode got together to clean up the area surrounding the site. Numerous seminars and group discussions had sharpened their awareness of environmental conservation, safety, fire prevention, and health protection issues. Specific improvements were also achieved in the site's adhesives and guar production lines. . . . . 37

Henkel Corporation

**Sophisticated operation**

Responsible Care – Henkel Corporation adopted this concept very early in the USA and Canada, following up with appropriate action plans. All of the sites are making continuous progress in improving environmental protection, safety and health. . . . . 39





**Henkel** is a specialist in applied chemistry. The Henkel Group comprises 246 companies in more than 60 countries. Group sales in 1996 amounted to DM 16.3 billion, of which 28 percent were generated in Germany and 72 percent elsewhere. The parent company is Henkel KGaA in Düsseldorf. Henkel is one of the most internationally structured groups in Germany.

## Specialist in Applied Chemistry

The Group employs 47,000 people, of whom 31,000 work for companies outside Germany. 9,000 of the 16,000 employees in Germany work at the Düsseldorf parent plant, which is the Group's largest production site. The Henkel Group is the world's largest supplier of oleochemical base materials (chemical products derived from renewable raw materials, such as coconut oil and palm kernel oil), and products for the surface treatment of metals. Henkel also supplies the most varied range of adhesive products in the world. In Europe, the Group is a leading manufacturer of

toiletries, detergents and household cleansers.

Together with an American company, Ecolab Inc., Henkel operates Henkel-Ecolab, a joint venture, in Europe. This joint company is the market leader in institutional hygiene and cleansing products and systems.

Applied research and development is one of the Group's core fields of competence. Extensive know-how, creativity and imagination are the starting points for successful innovation, high product quality, an optimal price-performance ratio, and the best

possible environmental compatibility in all of the Group's research projects.

### Environmental obligations of ecological leadership

One of Henkel's central corporate objectives is to be a global leader in environmental and consumer protection.

All Henkel companies, irrespective of their geographical locations, take account of environmental protection requirements in relation to all of their activities.

### Sales by regions, 1996

by customer location

Total sales: 16,301 (in DM millions)

Germany 4,507 (28%)

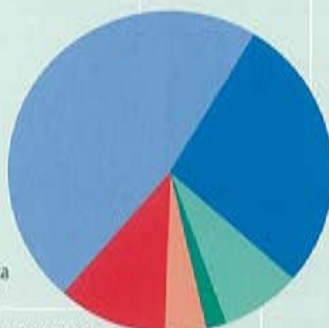
Rest of Europe 7,679 (47%)

North America  
1,886 (11%)

Latin America 644 (4%)

Africa 253 (2%)

Asia, Australia 1,332 (8%)



Henkel

### Sales by product groups, 1996

Total sales: 16,301 (in DM millions)

Chemical Products 4,186 (26%)

Surface Technologies 1,044 (7%)

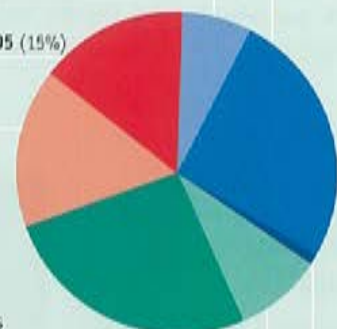
Industrial Adhesives/  
Technical Consumer Products 2,505 (15%)

Cosmetics/Toiletries  
2,677 (16%)

Detergents/Household Cleansers  
4,295 (26%)

Industrial and Institutional Hygiene 1,414 (9%)

Other 180 (1%)



Henkel



## Product Groups

### For industrial customers and for consumers

The Henkel Group manufactures almost 10,000 products. Worldwide responsibility for these products rests with six distinct business sectors.

#### Chemical Products

##### Oleochemicals

Fatty acids; glycerine and fatty acid derivatives; fatty alcohols and their derivatives; products for the cosmetics, toiletries and pharmaceutical industries, for detergents and household cleansers; aroma chemicals/perfume compositions; food and feedstuff additives; natural-source vitamin E and beta-carotene.

##### Organic

##### Specialty Chemicals

Base materials and additives for plastics, paints and coatings; auxiliary products for textile, leather and paper production; specialty products for mining, oil drilling, and for lubricants, for plant protection formulations and the construction industry.

##### Inorganic Products

Water glass

##### Surface Technologies

Chemical products and application systems for the surface treatment of metals and metal substitutes; lubricants; cleaning agents; corrosion inhibitors; products for conversion processing and water treatment; engineering services; antifreeze agents and corrosion inhibitors for motor vehicle cooling systems; CHC substitutes for cleaning applications; polyurethane adhesives and sealants; epoxide structural adhesives; PVC and SMA plastisols; dispersion adhesives; acrylates.

##### Industrial Adhesives/ Technical Consumer Products

##### Technical Consumer Products

Wallpaper pastes; ceiling, wall covering and tile adhesives; home decoration prod-

ucts; sealants; polyurethane foam fillers; contact adhesives; wood glues; PVC pipe adhesives; flooring adhesives; building chemicals; coatings; automotive after-products; superglues; glue sticks and roller applicators; correction products.

##### Industrial Adhesives

Dispersion adhesives; starch-, dextrin- and casein-based adhesives; hotmelts; polyurethane adhesives and sealants; contact adhesives; anaerobic- and aerobic-curing acrylates; cyanoacrylates; polyamides; epoxide structural adhesives; flock adhesives; rubber-to-metal bonding agents; cable sealing compounds; leatherboard.

##### Cosmetics/Toiletries

Toilet soaps; bath and shower products; deodorants; skin creams; skin care products; dental care and oral hygiene products; hair shampoos and conditioners; hair colorants;

hair styling and permanent wave products; perfumes and fragrances; hair salon products.

##### Detergents/ Household Cleansers

Universal detergents; specialty detergents; fabric softeners; dishwashing products; household cleansers; scouring agents; floor and carpet care products; bath and toilet cleansers; glass cleaners and lens wipes; furniture and kitchen care products; shoe care and laundry conditioning products; plant care products.

##### Industrial and Institutional Hygiene

Products, appliances, equipment, systems and services for cleaning, washing, maintenance, sanitizing and disinfecting applications at major institutional and industrial customers, in the food and beverage industries and in the agricultural sector.

The production processes at the individual sites must be safe for employees and the local community.

The Group works to increase public awareness of its ecological leadership role and to use this to boost its competitive edge in the marketplace.

There are adequate instruments within the Group for actively dealing with environmental topics. Henkel has two central departments in its corporate sec-

tor Research/Technology, which have focused on these tasks for many years.

#### Technical departments cooperate on environmental protection and safety

Environmental Protection and Safety handles all production- and site-related topics, including ►emissions\* and ►immissions, energy, waste gases, wastewater and noise, while Biological Research and Product Safety deals

with all aspects of product safety for mankind and the environment. The two departments cooperate with each other, as well as with the technical departments of the business or corporate sectors.

Environmental protection and safety concerns are by no means restricted to the experts, however. All employees are responsible for environmental protection, occupational safety, and health protection at their workplaces.

\* Terms marked with a ► are explained on pages 52 to 55.



# Management

Management

systems are an important instrument for advancing the development of safety, health, and environmental protection. Their systematic procedures reveal what has been accomplished, while simultaneously identifying areas where improvements can and must be achieved. Henkel keeps the public informed about this situation, for example, by publishing its environmental objectives in this report.



Teamwork is needed, in all parts of the Group, to translate environmental management into everyday practice. This photo was taken during a meeting at Henkel Corporation's plant in Charlotte, North Carolina.



**Responsibility for the future.** Sustainability must be the goal of all our economic activities today. We must ensure that subsequent generations will have the same opportunities for development as we ourselves had. This is the key principle of the Business Charter for Sustainable Development, as promulgated by the International Chamber of Commerce in Paris. Henkel was one of the first companies to endorse this declaration, in 1991.

## Responsible Care in the Henkel Group

On the occasion of the 1992 Earth Summit in Rio de Janeiro, the following objectives, summarized in Agenda 21, were agreed upon on the basis of this sustainability principle. For economic activity to be sustainable, equal priority must be given to economic, ecological and social considerations, and the challenge of putting this into practice in everyday life must be taken up by all sectors of society.

► Responsible Care has become an important instrument for achieving these objectives in the chemical industry. In February 1996, the Henkel Management Board resolved to implement the Responsible Care concept on a Group-wide basis and to develop an appropriate management system based on uniform global specifications. This system will be mandatory for all Henkel sites.

An international and interdisciplinary project team has already developed fifteen Henkel standards covering the six areas of Responsible Care, as well as all other business procedures within the Henkel organization. The system applies not only to product development, production, occupational safety and health, and purchasing and distribution, but also to activities such as external and internal reporting, contractor relationships, and the acquisition of new companies.

Each standard is defined in a detailed series of guidelines. These guidelines contain clear specifications for all Henkel companies, ranging from product clearance procedures, occupational safety measures, and production

safety plans to the measurement of ► emission levels and the training of external contractor personnel working on Henkel sites.

Naturally, considerable vigilance has been exercised to ensure that the Responsible Care management system will reflect internationally agreed standards, such as the European Union's ► Eco Management and Audit Scheme or the ► ISO 14000 standards.

One of the Henkel standards is exclusively dedicated to verifying and evaluating the implementation of the new system and the success of the measures taken.

### Establishing Group-wide standards and guidelines

The project team completed the standards and guidelines by the fall of 1996. A pilot project was launched to check their applicability and practicality within the various management sectors and at different international sites. In early 1997, the implementation phase was initiated throughout the Henkel Group.

The standards and guidelines were distributed, together with supporting explanations, throughout the Group. Each site was instructed to assess its own management system against the specified standards and guidelines. This task was facilitated by a set of checklists developed by the project team. The checklists incorporate a scoring system, which allows an assessment of the degree of implementation. The objective is for all

management sectors to complete these assessments, identify potential improvements in the management system, and prepare appropriate action plans by the end of 1997.

### SHE Management System

In order to distinguish the uniform Henkel system at the individual sites from the various national Responsible Care schemes of the chemical industry associations, Henkel refers to its system internally as the SHE Management System, whereby SHE stands for safety, health and environment.

The SHE management system is not intended to play an isolated role within the Henkel organization, however, but will be linked with other existing systems, such as Quality Management. For this purpose, a comprehensive, integrated and process-oriented management system, designated HIPROM (Henkel Integrated Process Management System), is being established within the Group.

The clear-cut structure of this system makes it easy for employees to find the sections which are related to their own activity and to identify the applicable specifications and standards in



The Responsible Care program is symbolized by the same logo worldwide.



the guidelines and manuals. This will considerably simplify their daily work.

In addition, the HIPROM system provides a clearly arranged outline of upstream and downstream processes, encouraging employees to take a fresh look at the overall process from a wider perspective. This stimulates creative thought, a valuable in-house source of innovative ideas on which Henkel relies to improve environmental protection, health, and safety.

## Continuous Improvement

# What does Responsible Care accomplish?

Responsible Care is a worldwide initiative developed by and for the chemical industry. It is an expression of its resolve to pursue continuous improvement in safety, health, and environmental protection, rather than simply to comply with minimum statutory requirements. It is the duty of each individual employee within the participating companies to use his or her personal skills for the benefit of mankind and the environment. The purpose behind this chemical industry initiative is to define achievable goals that will contribute to the creation of an ecologically, economically, and socially sustainable sce-

nario for the future. Since the Responsible Care initiative is intended to cover all fields of activity in the chemical industry, its focus is on the following six areas:

- Environmental protection
- Plant safety and emergency preparedness
- Occupational safety
- Product stewardship
- Distribution safety
- Internal and external dialogue

The chemical industry has committed itself to the goals of this initiative in 40 countries worldwide - from A for Argentina, through Brazil, Malaysia, Poland and Turkey, to Z for Zimbab-

## Principles and Objectives of Environmental Protection and Safety

### How we interpret our responsibility

As a leading company and Specialist in Applied Chemistry, Henkel accepts its responsibility to society. As one of the first companies to endorse the Business Charter for Sustainable Development of the International Chamber of Commerce, we are committed

to its principles and to the international program Responsible Care®.

We are committed to developing and supplying products and systems that offer special benefits to our customers in all parts of the world. Along with this performance and quality leadership, we are committed to ecological leadership (Eco Leadership).

This includes continuously improving plant safety, environmental and health protection, as well as occupational safety. We set ambitious goals for ourselves. With the aid of efficient management systems, we monitor the progress, making our results available both internally and externally.

We encourage our business partners and suppliers to aim for the same standards of en-

vironmental protection and safety.

Our corporate culture promotes our employees' true dedication to their jobs. Through multifaceted programs, we develop and promote our employees' understanding of environmental protection and safety. We recognize that these demanding standards can only be met by motivated and creative employees.

### Goals we have set for ourselves

Sustainable Development must give equal priority to economic, ecological and social goals. Only economically successful companies will be able to contribute to effective environmental protection and social progress.

### Products

Henkel supplies only products and systems that are recognized by acknowledged scientific criteria as environmentally compatible. To make sure that our products and systems are used safely, we inform and advise our customers on an ongoing basis.

### Production

Throughout the world, all our production processes are designed in such a way that, if properly operated, our employees and our neighbors are not exposed to any health hazard. In order to maintain and enhance the safety of our existing manufacturing plants, we carry out regular and systematic checks according to uniform Group-wide criteria. Through continuous improve-





we. The national chemical industry associations provide support in achieving these goals. The organization, rate of implementation, and specific content of the Responsible Care programs vary from country to country, depending on local circumstances, including the legislative framework.

### Definition and communication of company guidelines

The programs are adapted to national conditions and start at different levels. One common feature, however, is that they all call for the creation of a management system to define and communicate company guidelines, to carry out company-wide 'stocktaking,' and to subsequently formulate

corporate management objectives. These requirements must be translated into an implementation program, which should then be continuously monitored against defined targets.

### Ambitious requirements and continuous improvement

Since corporate management defines new, ambitious goals as soon as the previous targets have been met, a 'control loop' is created which generates the desired continuous improvement. The fact that Henkel intends to implement an identical standard in its more than 200 subsidiary companies in over 50 countries has made it necessary to create an additional management system, binding for all Henkel companies, to complement

the specifications of the national chemical industry associations.

This means even more safety for the communities neighboring on Henkel's production sites, reduced emissions into the environment, far-reaching conservation of resources, and enhanced occupational safety and health protection for employees. The customer can select from an even broader range of high-performance products, which can be handled without risk to mankind and the environment. For Henkel's suppliers and contractors, in turn, this mandatory management system calls for a critical evaluation of their own environmental protection, occupational safety, and health performance.

ments, we reduce the potential for accidents and any adverse impact our plants may have on the environment.

In the development of new production processes and in the construction of new plants, important components of conception and planning are environmental protection and safety, low consumption of resources, as well as minimizing emissions and waste.

### Occupational safety

Protecting employees at work from health hazards is a top priority for Henkel.

Our occupational safety concept is based on an integrated approach that includes the organization of the work, safety management, safety technology, production processes, the

substances used, and occupational health precautions.

### How we intend to achieve our goals

#### Management systems

We utilize management systems to maintain our environmental standards and monitor the degree to which our environmental and safety goals have been achieved. Regular audits are part of these systems. Henkel's own internal rules are binding for all concerned.

#### Employee motivation

With our ongoing environmental protection and safety training, we sensitize our employees and ask them to contribute to environmental protection and safety at each

workplace and in each working environment.

All our employees are committed to the goals of plant and occupational safety and environmental and health protection. To achieve this, employees with leadership responsibility are given the necessary decision-making authority, adequately qualified personnel and the necessary resources.

Employee performance in matters of environmental protection and safety is taken into account both in performance reviews and career planning.

#### Technology transfer

We systematically carry out the Group-wide transfer of technologies and management methods in the fields of environmental and health protec-

tion and safety. In that way, we also contribute to global social progress.

#### Dialogue

We encourage our employees to work at all levels on issues relating to environmental protection and safety.

In dealing with the public, we seize the initiative. We inform the public regularly, candidly and fully - even when we have made mistakes.

Questions and concerns on the part of the public are treated seriously and are responded to.



## Third-party verification

**Environmental management system certification**

In recent years we have seen the emergence of international standards for the assessment of corporate environmental management systems. Within the European Union (EU), one such standard is the ►Eco Management and Audit Scheme, whereas ►ISO 14001 has been adopted at the wider international level. These two standards are comparable, but not identical. The publication of an environmental statement, for example, is required only under the EU's Eco Management and Audit Scheme. However, both standards call for accreditation by an external certification body, which carries out an ►audit for this purpose. The comprehensive preparatory work for such an audit must be performed by the company seeking accreditation.

Henkel expects its participation in this public auditing system to yield both internal and external benefits. In-house effects are achieved through the documentation of the management system, i.e., its organizational and operational structure, as well as through audits of individual plants. Both are helpful in identifying a plant's strengths, as well as its potential for improvement. At the same time, the environmental statement serves as a new public communication platform.

The first three Henkel sites were certified under the EU Eco Management and Audit Scheme in 1996, beginning with Kepec Chemische Fabrik in Siegburg, near Bonn. This was followed by the successful audit of the Henkel parent plant in Düsseldorf, despite the particularly complex nature of this site. The third successful candidate was Gerhard Collardin in Herborn-Schönbach (Hesse), a Henkel Surface Technologies subsidiary, which, in view of its highly international clientele, was certified not only under the EU Eco Management and Audit Scheme, but also to ISO 14001.

As a conclusion to the audit, the accredited auditors from Lloyd's Register Quality Assurance emphasized the universally high degree of employee motivation and praised a number of other aspects, such as the comprehensive structure of the Collardin and Kepec environmental management systems and the systematic employee training program at Henkel's Düsseldorf site.

## Eco portfolio analysis

**How viable is a product?**

The problem has been around for a long time: How can a company best initiate and carry through the development of products that satisfy the criteria of economic and ecological sustainability? How can a manufac-

turer arrive at an unambiguous assessment of the ecological and economic viability of his products? For Henkel, there is another question, too: Which products will contribute to the corporate goal of Eco Leadership?

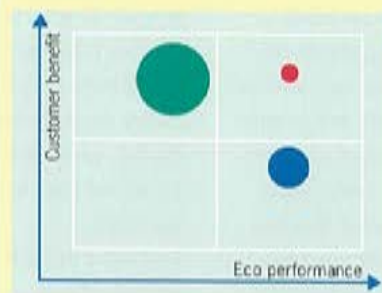
The answer to these questions is given by an ecological portfolio analysis. This is a method of showing the eco performance spectrum of a product in relation to its customer benefits. The eco performance of a product is a measure of its ecological strengths and weaknesses, evaluated according to the criteria of sustainable development. These include the use of resources (type and quantity of raw materials required), and the product's behavior and fate in the environment (►ecotoxicity, degradation patterns, influence on the greenhouse effect, ozone depletion). In this way, ecologically and economically sustainable products can be easily identified.

## Life cycle assessment of adhesives

**Exemplary properties**

Liofol is the name of a group of advanced adhesives, marketed by Henkel for use in the manufacture of composite plastic films and aluminum foils. These films and foils are employed for wrapping foodstuffs, such as instant meals or coffee. A Henkel subsidiary, COGNIS Industrial Consulting, has now compared and evaluated the ecological properties of ►solvent-free, ►water-based, and solvent-based Liofol ►polyurethane laminating adhesives as part of a ►life cycle assessment.

The solvent-free Liofol adhesive came out on top. As could be expected, it showed obvious ecological advantages over the conventional solvent-based adhesive. In addition, its environmental compatibility was signifi-

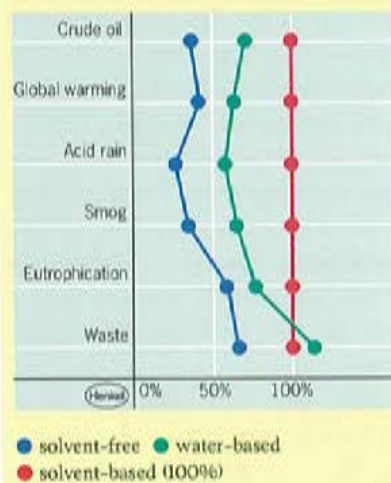
**Example of a portfolio analysis  
Varying customer benefits of products**

A portfolio matrix consists of several fields, representing different combinations of attributes. The ecological evaluation of a product is shown in terms of the relationship between customer benefit and eco performance, with the size of the circles representing the product quantity that can be sold on the market. This makes the strategic opportunities immediately identifiable.



cantly greater than that of the water-based reference product. The primary energy input required for the solvent-free Liofol variety was about 60% below that of the comparable solvent-based formula. Compared with the water-based product, about 30% less energy was required.

### Life cycle assessment Polyurethane laminating films



### Waste management

## Residual Materials Management Project

In an effort to increase waste recycling rates and develop safe concepts for the removal of waste from all German production sites, while also reducing costs, Henkel has launched its "Residual Materials Management for Germany" project. In the first stage of this project, the various waste types and quantities, together with the associated recycling or disposal routes and costs, were recorded and then documented in the form of a register.

The close cooperation and exchange of experience among all German pro-

### Principles translated into Turkish

#### Environmental objectives made more accessible

Henkel's principles and objectives in the field of environmental protection and safety (see pages 8 and 9) were revised and circulated throughout the organization in 1995. The text was distributed in the Group's two working languages, German and English. The management of the Türk Henkel site in Ismir, Turkey, was determined to make these

principles intelligible to all of its employees, not just those conversant with German or English.

The principles and objectives were translated into Turkish, modified to reflect local conditions, and distributed among all employees in the form of a bilingual (Turkish/English) brochure.

duction sites is expected to yield far-reaching synergetic effects. In many cases, it may be possible to consolidate waste from several sites, to reduce the costs of proper disposal.

### Environmental monitoring

## Surfactants in rivers

In the late 1950s, Henkel launched one of the first German river monitoring programs, on the Rhine. Ever since that time, the surfactant load in the Rhine has been systematically analyzed. In the first phase, researchers' interest was focused on measuring surfactant concentrations. The Rhine was then considered to be one of Europe's dirtiest rivers. A trend reversal occurred in the mid 1960s, when pollution levels began to decline markedly as sewage treatment plants were extensively upgraded and new biodegradable surfactants came into use.

A key role in this context was played by the readily biodegradable alkybenzene sulfonate (LAS). Today, Henkel increasingly uses surfactants derived from renewable raw materials, such as alkyl polyglycoside (APG<sup>®</sup>) and fatty alcohol sulfate (FAS). These products offer the advantage of being quickly, easily, and completely

biodegradable, indeed far more so than is legally required. In the second phase of environmental monitoring, researchers are examining what happens to those small amounts of surfactants which enter streams and rivers via the discharge from sewage treatment plants. In one of these experiments, Henkel's ecologists prepared so-called concentration profiles for LAS and FAS along the Anger and Rur rivers, in an effort to determine the downstream biodegradation rates. The experimentally determined half-life of both surfactants was found to be just a few hours - significantly below the 360-hour safe limit set by the European Union for detergent surfactants.



Environmental monitoring on the Rhine: a scientist takes water samples at Düsseldorf-Himmelgeist.





Henkel neighbors show keen interest during a visit to the Düsseldorf parent plant.

Dialogue with the public

## Open house attracts neighbors

Communication is good for everyone. At an open house, neighbors get a chance to look behind the scenes, while the companies themselves have a valuable opportunity to engage in a dialogue with the public. A total of nine Henkel sites in Germany, France and the USA held such events in 1996. Their importance is documented by Henkel's neighbors themselves. The Düsseldorf parent plant had 20,000 visitors, including 3,000 young people, who took a special interest in the apprentices' workshops and vocational training programs.

Neighbors also flocked to the smaller subsidiaries. Gerhard Collardin, in Herborn-Schönbach, attracted over 700 visitors, as did Kepec Chemische Fabrik, in Siegburg. Similar success was registered by Henkel France, in Reims, as well as the three US sites, in Cedartown, Georgia, Hoboken, New Jersey, and Los Angeles, California.

Visitors showed an interest in a wide range of subjects. Apart from seeking information on the products made, many had come to get an idea of current working practice and production conditions. Questions also revolved around environmental protection and

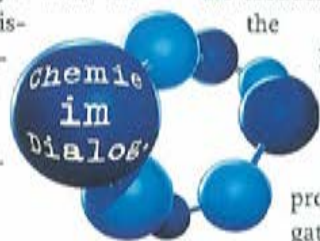
safety activities, the business situation, and job security.

Open house events are just one means of conducting a dialogue with the neighbors. Frequent discussion groups and informative presentations at all Henkel sites ensure a continuous exchange of views.

Safety brochure

## What to do in an emergency

"What Henkel Does for Your Safety" is the title of a brochure first published in 1992, in accordance with Section 11a of the German Industrial Accidents Ordinance, to provide information for those who live and work around our Düsseldorf parent plant. An updated version, with an improved layout, became available in September 1996. The new edition will also be more easily understood by foreign readers, as the emergency instructions are printed in six languages.



Discussion panels

## Strengthening communication

A new form of regular community dialogue has been developed by the US subsidiary, Henkel Corporation, at its plants in Cincinnati, Ohio, and Kankakee, Illinois. The Henkel-Ecolab site in Nieuwegein, in the Netherlands, and Henkel Ireland, near Cork, have opted for the same approach. Discussion groups, known as Community Advisory Panels (CAP), have been established, bringing together members of the local community and company employees. The discussions, in which an external moderator often participates, provide an opportunity to talk about local site activities, as well as any problems which may arise.

Ideally, each CAP should represent the broadest possible cross-section of the community, including lawyers and students, conservationists, and business people. Although the main purpose is to provide information and gather feedback on community affairs and concerns, experience shows that the CAPs also promote greater appreciation of the Henkel site among its neighbors, and that CAP members frequently take up Henkel's cause in their community.

Henkel Corporation's plant in Hoboken, New Jersey, is planning a CAP in cooperation with other industrial facilities in its neighborhood. The Cedartown, Georgia, plant has also started a dialogue with the local community, while Henkel Polska has embarked on talks with the citizens of Raciborz in the context of a municipal environmental conservation program.



Hazard control programs

## Regular drills

Emergency drills are becoming a permanent feature of preventive hazard control at an increasing number of Henkel Group sites. They comprise not only the emergency practice runs carried out by plant fire departments, for instance, but also full-scale drills for practicing cooperation between individual sites and external emergency services when danger threatens. Emergency management procedures are tested in a variety of pre-

defined hypothetical scenarios (e.g., a fire or the accidental release of a hazardous substance).

At Düsseldorf-Holthausen, a total of five such drills was held in 1996. As in Kankakee, Illinois, in the USA, and Cork, Ireland, all of the exercises were organized and evaluated by independent consultants.

The US plants in Cincinnati and Los Angeles have also instituted an emergency practice program. For the Los Angeles exercise, for example, the assumed hazard scenario was an earthquake, measuring 8 on the Richter scale.

In some cases, the drills are conducted in cooperation with local emergency services or neighboring companies.

Another important element of these emergency drills is the subsequent after-action meeting, where experience is exchanged and problem areas are identified.

All of the emergency drills have brought forth a wealth of information on potential improvements. The plants involved will therefore be repeating these exercises on a regular basis.

Drills have been scheduled at a number of additional sites in 1997.

### Yellow card

#### Valuable help in a company emergency

Emergency drills yield a wealth of insights that may lead to the development of new solutions. One such result is the introduction of "yellow cards." Unlike its equivalent on the soccer field, the "yellow card" is not

a disciplinary instrument, but a very valuable tool. It contains instructions on initial emergency action for a specific production plant and situation. In clearly arranged form, it provides answers to questions such as what needs

to be done first, what can wait, who should be informed, etc. It thus enables employees to take the required action quickly and in the appropriate sequence, without omitting important steps under the stress of an

emergency situation.

The pocket-sized "yellow card" can be kept easily at hand. Work on the preparation of yellow cards has already started at many production plants.

Priority	Emergency action	Accident requiring rescue services	Fire/Explosion	Gas/Vapor Release	Liquid Release	Action completed (time)
1	Contact emergency call number (who? where? what? when?)	Yes	Yes	Yes	Yes	
	Administer first aid, if this is possible without risk	Yes	Yes	Yes	Yes	
	Activate fire alarm		Yes			
	Fight initial fire with fire extinguisher, if this is possible without risk		Yes			
	Close fire doors		Yes	Yes		
2	Close doors and windows; turn off ventilation system		Yes			
	Perform Emergency Stop procedure; shut down process and plant		Yes	Yes		
	Leave hazard area via escape routes; assist individuals not familiar with the plant		Yes	Yes		
	Wait for plant fire department to arrive, then brief them on the situation	Yes	Yes	Yes	Yes	
	Isolate the hazard area	Yes	Yes	Yes	Yes	
3	Inform neighboring departments		Yes	Yes	Yes	
	Take measures to prevent unauthorized access		Yes	Yes		
4	Inform superiors	Yes	Yes	Yes	Yes	
	Await squad leader's instructions	Yes	Yes	Yes	Yes	
	Proceed to meeting point, checking that everybody is present		Yes	Yes		
	Have substance data (data sheets, inventory lists, etc.) at hand for use by squad leader	Yes	Yes	Yes	Yes	



Help for Philippine coconut farmers

## Capable cooperators

Coconut farmers on Mindanao, the Philippines' second largest island, are becoming small-scale entrepreneurs. The German Agency for Technical and Economic Cooperation (GTZ) and the Philippine Coconut Authority, a Manila-based state coordination organization, are helping them to help themselves. The third party involved, since 1996, is Henkel, which provides financial assistance for the development project.

To enable the Philippine coconut farmers to develop their own resources, GTZ advises and assists them in setting up cooperatives. Once the farmers have taken the first step and organized a cooperative, GTZ and Henkel facilitate the building of



Copra dryers help Philippine coconut farmers to increase profits.

equipment such as copra dryers. Until now, the farmers have dried their copra (coconut meat) on outdoor racks, exposing it to rain and dew, which promote mold and mildew growth. The copra quality therefore suffered, and sales revenue remained at a fairly low level.

The simple kilns represent an effective solution. With help from Henkel and GTZ, five cooperatives have been able to build 13 copra dryers to date. Making full use of the materials at hand, the dryers are fired with charcoal prepared from coconut shells.

Environmental Competition Award

## "Eco Iris" for Henkel Belgium

Institut Bruxellois pour la Gestion de l'Environnement (IBGE), a Brussels-based environmental management institute, holds an annual competition in the greater Brussels area. Its "Eco Iris Bureau" is a prize for outstanding environmental achievement in the office and administration sector by companies, municipalities, and associations. In 1996, five industrial companies were among the award winners selected from a total of 148 entries. The first prize went to Henkel Belgium.

The 10-member jury, made up of representatives of various industry associations, municipal organizations, media, universities, and the Belgian Ministry of the Environment, ex-

plained their choice by pointing out that the waste-reduction project was devised by the staff at Henkel Belgium's head office, and that it could not have succeeded without the active commitment of all employees, numbering some 200.

Waste reduction was actually only one key aim of the project. Another was the purchase of more environmentally compatible office supplies. An additional aspect, which the jury found remarkable, was the manner in which the project had been communicated to the staff, e.g., via frequent messages on their computer screens.

Exemplary strategies

## Eco leadership

Every two years the Bundesverband Deutscher Unternehmensberater (BDU) (Federation of German Man-

agement Consultants) presents an award for exemplary corporate strategies and methods. The winner in 1996 was Dr. Hans-Dietrich Winkhaus, President and Chief Executive Officer of the Henkel Group.

### Strengthened innovative force

The Federation of German Management Consultants explained its choice by emphasizing three factors: his encouragement of innovation within the Company, his successful personnel policies, and his consistent pursuit of the key corporate objective of Eco Leadership. Henkel's comprehensive ecological orientation was particularly noted in the award presentation speech.

Dr. Winkhaus thanked the jurors, stating that he accepted the award on behalf of all of the Company's employees, as this success could not have been achieved without their input.



Prestigious prize

## European Environment Award for Henkel Ireland

The European Union holds a competition every second year, for its "European Better Environment Award for Industry" (EBEAFI). The two-stage procedure starts with the selection of national award winners in each country. At this level, Henkel Ireland received no fewer than two awards, in the "Waste Recycling" and

"Management towards Sustainability" categories.

In the Management category, Henkel Ireland also scored at the European level. The Henkel subsidiary was the only Irish company to receive an EBEAFI award, from among a total of 81 European entrants.

This makes Henkel Ireland the first

Henkel company to be honored with this European environmental prize. (In the previous competition, held in 1994, Henkel Düsseldorf received two national awards.) The awards were presented during a formal ceremony at Dublin Castle by Mary Robinson, President of the Republic of Ireland and current President of the Council of the European Union.

Competition helps to preserve forests

## Giving nature a chance

An idea developed by the Hans Schwarzkopf subsidiary to enhance its customers' ecological awareness, while providing funding for a specific nature conservation project, was a major success for the second time in 1996. Schwarzkopf developed the campaign in collaboration with the Naturschutzbund Deutschland e.V. (NABU) (German Nature Conservation Association). Its purpose was to support a NABU project aimed at the near-natural management of forest

areas in Germany.

The project comprised the development of a concept demonstrating the compatibility of nature conservation and forest management. Through a retail-level promotion program on the theme "Give Nature a Chance," Schwarzkopf successfully encouraged consumer involvement in the project. A competition was held, giving contestants the opportunity to win two 'nature vacation trips' in Europe, as well as 500 other prizes.

Schwarzkopf committed itself to donate one German mark to the NABU project for every reply card received. Consumers participated far more actively than expected. Some 50,000 entrants returned their cards, demonstrating their commitment to nature conservation and environmental protection. On October 18, 1996, a representative of Schwarzkopf's promotion department presented NABU's president, Jochen Flasbarth, with a check for DM 50,000.



A Schwarzkopf promotion campaign supported a nature conservation project.

### Environmental theater Sticking With The Rainforest

"Sticking With The Rainforest" is the theme of an environmental project by the Kazzum Arts Project, a children's theater company which has collaborated with British schools for the past six years to develop children's understanding of ecological issues. In this case, their work is focused on the destruction of the rainforest. Kazzum uses a broad range of techniques, including the "Play in a Day," workshops, teachers' packs, and one-week residencies in which children aged 6 to 11 prepare a large-scale production themselves. In

each project, the children use glue to paste together paper and cardboard materials. For the British subsidiary, Henkel Limited, this was reason enough to donate free Pritt adhesives to the Kazzum Arts Project for its handicraft activities, in addition to providing direct financial help. All Pritt products are ▶solvent-free. Thanks to Henkel's support, Kazzum can give schools a discount on project costs, thereby allowing poorer schools to participate as well. Thanks to Pritt, Kazzum will be able to reach more than 100 British schools in 1997.



# Products

Henkel develops and supplies

products and systems that offer special benefits to its customers.

It strives to achieve not only optimal product performance, but also

the highest levels of environmental compatibility. This commitment

is embodied in the entire product range. As part of its comprehensive

product stewardship, the Company monitors the effects of its

products on mankind and the environment, fully aware that its

responsibility does not stop at the factory gate.



Throughout Europe, Henkel's manual dishwashing products are formulated with alkyl polyglycosides (APGs), a class of compounds based on renewable raw materials. This makes them environmentally compatible, yet powerful and still gentle to the skin. The picture shows a dishwashing test in our Düsseldorf product development laboratory.



**Ecological challenge.** Henkel decided to place its faith in renewable raw materials many years ago, and not without good reason. They help to conserve non-renewable resources, thereby reducing the burden on the environment. For example, no additional carbon monoxide, which could contribute to the greenhouse effect, is released during their biodegradation. The products not only meet stricter environmental standards, but are also tailored to the demands of manufacturers, consumers, and the environment.

## Renewable raw materials are in demand

Cosmetic products made from shrimps

### All in the shell

It was in the early 1980s that the Care Chemicals section of the Chemical Products business sector first discovered the merits of shrimps. The experts' attention was focused not so much on their delicious interior, however, but on their hard exterior. The chitinous shell is a source of active ingredients for cosmetics and pharmaceuticals.

This unusual substance constitutes a valuable addition to the Company's range of renewable raw materials, which until then had mainly included sources of vegetable oils, such as coconuts, palm kernels, rapeseed and sunflowers, as well as protein products derived from wheat and rice.

The chitosan obtained from chitin is known for its outstanding ► ecological and ► toxicological properties. Chitosan solutions have pronounced care



A hair strand treated with chitosan is tested for its bending strength by suspending a beaker from it. The more water that can be added to the cup, the greater the strength imparted by the chitosan solution.

properties and are used as active ingredients in ► emulsions, deodorants, and hairstyling products.

Tests have shown that emulsions containing chitosan are absorbed quickly

and do not irritate the skin. Water is retained longer, improving the skin's moisture content. The result is smoother, softer skin.

In deodorant formulas, chitosan inhibits bacterial growth on the skin surface, thereby preventing perspiration odor. In hairstyling products, chitosan adds the desired form strength, while preventing the hair from drying out or splitting.



### Norwegian shrimps

#### High quality from the deep

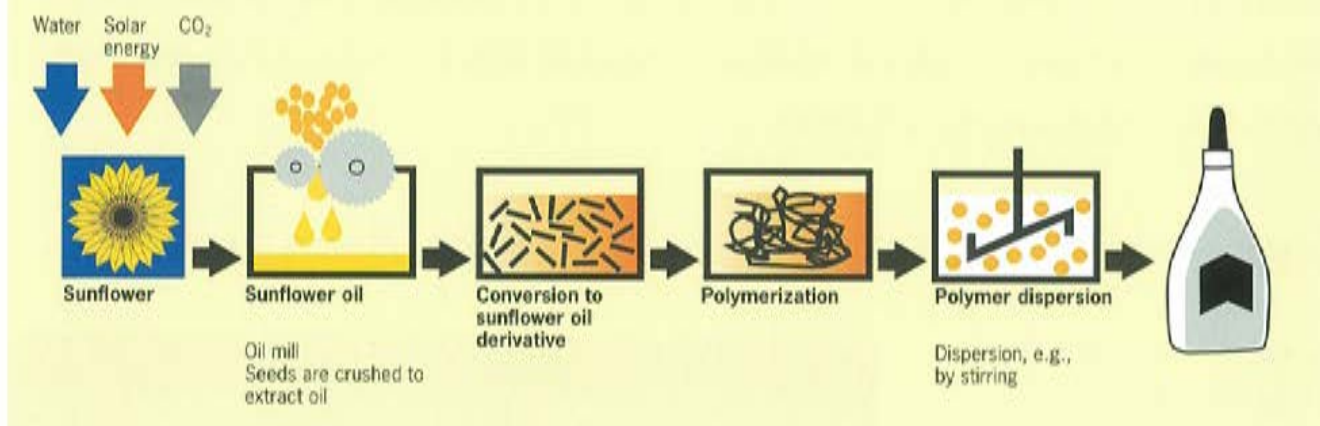
Chitosan is obtained from chitin, a substance occurring in the shells and exoskeletons of shrimps, crabs and insects. Insect exoskeletons, for example, contain up to 60 percent chitin. The dried shells of cold-water shrimps constitute a raw material of unvarying quality, with a chitin

content of up to 3 percent. The shrimps are trawled mainly in the coastal waters of Norway and Greenland. In collaboration with a fishery institute based in Tromsø, Norway, Henkel has developed a process for producing high-grade chitosan.



## Adhesives from nature

### From sunflower to dispersion adhesive



Raw materials for polymer dispersions

### Vegetable-based adhesives

As the world's largest manufacturer of products based on vegetable and animal oils and fats, and the most important international producer of adhesives, Henkel has embarked on a new research project with which it hopes to set new standards. Instead of using only ►dispersions derived from petrochemicals, as was previously the case, the Company intends to make increasing use of renewable raw materials as the basis of its product formulas.

In the field of adhesives and sealants, numerous products are already formulated on the basis of renewable raw materials. Starch, ►cellulose, protein, and vegetable oils and fats are the main ►derivatization feedstocks.

More extensive exploitation of renewable raw materials is hindered by their limited performance spectrum. In the NARODIS project, Henkel is attempting to develop aqueous raw materials

with superior performance and environmental compatibility characteristics. The German acronym NARODIS stands for "renewable raw materials for dispersions." Typical dispersion products include wood glues and numerous adhesives for floor and wall coverings and for packaging products. The renewable raw materials studied in the NARODIS project are to be manufactured from the fats and oils of indigenous plants, such as sunflower and rapeseed.

For Henkel, this development constitutes another important milestone, since the production of dispersions with the highest possible concentrations of renewable raw materials will help to conserve petrochemical resources.

The project is supported by the German Ministry of Agriculture. Crucial factors in obtaining this support were Henkel's extensive expertise in oleochemistry and adhesives technology, and the benefits that would accrue to

the German agricultural sector as a supplier of basic raw materials for the chemical industry.

The skin sensation

### Naturally smooth

Consumers appreciate body care products which spread easily on the skin. To ensure that their creams satisfy this requirement, cosmetics producers add carefully matched oils. The Cospha sector of Henkel Chemical Products now supplies a new oil made from renewable raw materials, whose sensory properties can be ideally incorporated in so-called high- and low-spreading oils. When the formulation is applied to the skin, it creates an intense, cascading sensation of smoothness. The customer benefit lies in the increased acceptance of these creams by the cosmetics consumer. In addition, marketing concepts can exploit the product's natural origin.





Alkyl polyglycosides

### Skin-friendly throughout Europe

The new ▶surfactant generation of ▶alkyl polyglycosides (APGs) continues its triumphant advance. APGs bring about significant improvements in performance when combined with other surfactants. They also exhibit excellent skin compatibility, and as a result they are now used throughout Europe in soaps, shower gels, and face-cleansing syndets, as well as manual dishwashing detergents.

With two production plants in Cincinnati, Ohio, and in Düsseldorf, Henkel is the world's largest manufacturer of APG.



The APG surfactants contained in these dishwashing liquids are powerful, yet gentle to the skin.

APGs are made of ▶glucose and ▶fatty alcohols obtained from corn or potato starch and coconut or palm kernel oil. They are considered to be virtually ideal surfactants. APG-based products include light-duty and universal detergents, all-purpose cleansers, manual dishwashing liquids, hair shampoos, shower gels, toothpastes, and industrial cleansing agents. They are powerful stain and grease removers, yet very mild in contact with the skin and hair.

Polysaccharides for the textile industry

### Sweet helpers

With its new ▶sizing and ▶dispersing agents based on ▶polysaccharides, Henkel supplies the textile industry with a product line based on renewable raw materials. The environmental compatibility of these products is truly amazing: they are readily biodegradable, can be used instead of non-renewable fossil raw materials, and therefore help to conserve natural resources.

Sizing agents are indispensable to the textile industry, since they reduce friction during the weaving process by coating the fibers with a thin film. Dispersing agents are no less essential. They allow dyes to be dissolved uniformly or distributed finely in a ▶dyeing liquor and show their full potential when used with water-insoluble dyes.

In the past, the textile industry used sizing and dispersing agents which were poorly biodegradable in wastewater. With its new products based on sugar building blocks, Henkel achieved a pioneering breakthrough. Polysaccharides are readily biodegradable, even under difficult effluent treatment conditions. This means that the new products are eliminated completely in biological wastewater purification plants.

The raw materials for these newly developed sizing and dispersing agents for the textile industry are obtained from the seeds of Asian legumes, such as the guar and cassia plants, as well as from the resins of tropical fruit trees.

Wheat proteins

### Skin and hair care

The High Care unit within the Chemical Products business sector has started to market a number of new raw materials based on wheat and rice proteins and intended for use in skin and hair care products. These new ▶additives are well tolerated by the skin and mucous membranes, and provide effective hair protection.



Skin research in vitro: visual assessment under the microscope.

Adhesives for floor coverings

### The new generation

In only three years, Henkel Bautechnik has managed to develop an innovative adhesive base for a new generation of adhesive products. One key feature distinguishing the new carpet glue from conventional formulas lies in its unusually low specific gravity. Its advantages are that it cuts consumption by up to 30 percent, weighs less (lower transportation costs), and handles better. This innovative carpet glue is odorless after setting and already complies with future requirements for very low-▶emission ▶dispersion adhesives.

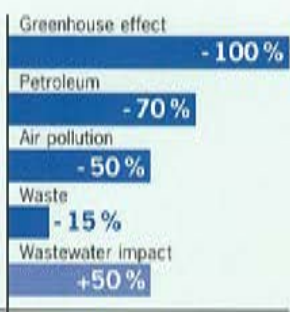




**Product stewardship** means adopting a responsible attitude toward all health, safety and environmental aspects of a product throughout its life cycle, i.e., “from the cradle to the grave.” Product stewardship is the application of ▶ Responsible Care to products.

# Today’s principles for tomorrow’s world

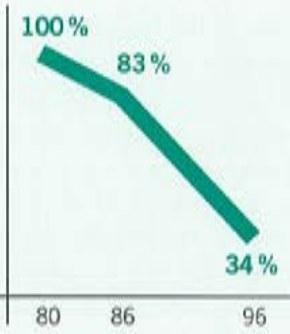
### FAS surfactant eco profile



### Renewable raw materials

Numerous studies have demonstrated the superiority of products based on renewable raw materials, such as ▶ fatty alcohol sulfate (FAS), over petrochemically derived products. They make no contribution to the greenhouse effect when the raw materials biodegrade, and they reduce petroleum consumption, air pollution and waste. However, they do cause higher levels of wastewater pollution due to the use of small, decentralized treatment plants in the production chain.

### Less energy



### Technology leap

Sometimes a technological quantum leap is necessary to reduce environmental pollution. The extrusion method for the manufacture of Megaperls® products has led to a steep rise in the energy efficiency of the entire production process. Expressed in terms of one washing cycle, 66 percent less primary energy is required.

### Packaging material quantity

In kilograms per metric ton of product



### Less packaging

Thanks to recyclable refill packs and paper cartons, together with the elimination of secondary packaging, 47 percent less packaging materials are now used than in the early 1980s. For many detergents and household cleansers Henkel uses its lightweight eco bottle, which saves 80 percent on plastics.

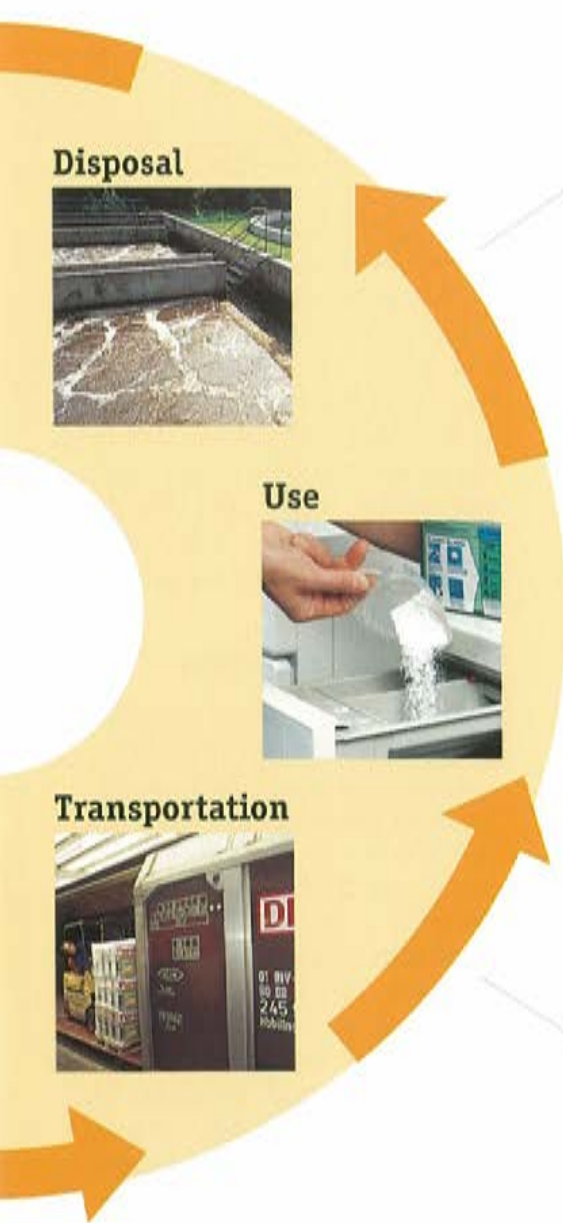




Never start something without thinking it through to the end. At Henkel, we have given this approach the status of a management principle. It is referred to as Product Stewardship, meaning a company's responsibility to mankind and the environment at all stages of a product's life cycle. This

begins with the selection of raw materials, continues through production, packaging, transportation and use, and ends with disposal. The management system ensures that all relevant environmental, health and safety aspects are measured, assessed, and, if necessary, improved, at each

stage of a product's life cycle. As is shown below, using detergents and household cleansers as an example, significant environmental benefits can be realized during every phase of this cycle.



**Disposal**



**Use**



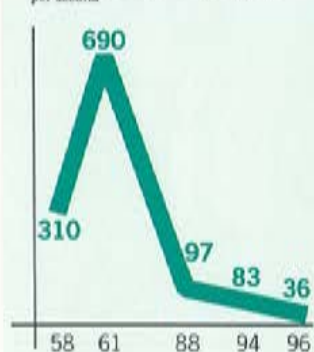
**Transportation**



**Guaranteed safety**

All of the detergents used in washing procedures pass into the environment with the wastewater. Monitoring the surfactant loads in major German rivers provides reassurance that products do not cause lasting environmental damage after leaving the manufacturer's premises.

**Environmental monitoring**  
Surfactant load in the Rhine, in grams per second



**All-around success**

Modern detergents are used in very small amounts. The improved washing performance of the Megaperls products has allowed another marked reduction in recommended dosage levels. As a result, today's washing cycles require 65 percent less detergent than they did in the early 1980s.

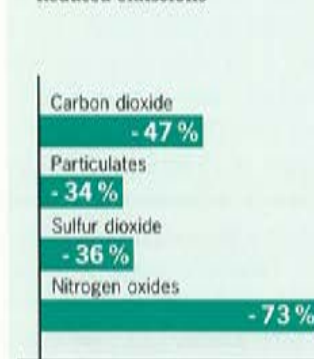
**Less detergent**  
Grams per washing cycle



**Rail transportation preferred**

Under Henkel's eco logistics concept, palletized detergents are shipped by rail rather than long-distance trucks, and urban logistics are rationalized. The ecological benefits include not only an annual 7,600-ton reduction in pollutant loads, but also significant fuel savings, despite growth in the quantities shipped.

**Reduced emissions**





**Smart solutions for advanced and environmentally compatible automotive development.** Research and development lead to a multitude of detailed, yet crucial, advances in automotive design. Though barely visible to the driver, these improvements are nevertheless an indispensable precondition for state-of-the-art manufacturing, for the enhanced quality and longevity of modern automobiles, for lower fuel consumption and for high recycling rates.

## Minor changes, major effects



Adhesives for direct glazing of windshields: testing an applicator robot at Henkel Teroson, Heidelberg.

Henkel Teroson in Heidelberg and Henkel Surface Technologies in Düsseldorf are dedicated to the systematic development of ecologically optimized products which improve the overall environmental compatibility of the final product, i.e., the automobile. This process requires intense and expensive research and development work on the part of Henkel and its customers.

Close cooperation with customers is essential if these improvements are to have the desired effect. Some users have to redesign their manufacturing processes, often at considerable investment cost. On the other hand, a mere change in process chemicals may reduce a manufacturer's wastewater volume and energy input level. Moreover, Henkel's products improve the overall environmental performance of the final product, i.e., the automobile. This is illustrated by the following examples.

One successful outcome of such interaction is a new polyurethane adhesive from Henkel Teroson. Used for the direct glazing of windshields in passenger cars, trucks, agricultural tractors, buses, and railroad wagons, this product demonstrates how a small change may have far-reaching environmental effects. With a bonded windshield, there is a smooth, even transition between the glass and the autobody, and this improves the vehicle's drag coefficient. In addition, the bonded glass increases the torsional stiffness of the vehicle structure, i.e., the strength of the bond imparts added stability. Manufacturers can, therefore, dispense with sheet metal reinforcing members elsewhere in the bodywork. Summing up, the use of this adhesive results in a lighter, more aerodynamic vehicle. This, in turn, results in reduced fuel consumption, thereby conserving non-renewable resources.

Steel, aluminum and plastics can now be directly bonded to each other with ►epoxide and polyurethane adhesives, enabling lightweight structures to be built.

Underbody sealing compounds are of the ►plastisol type. The use of thin-layer materials and products of lower specific gravity has reduced the thickness of underbody coating to a mere 0.1 to 0.2 millimeters, which translates into a 50 percent weight reduction.

Autobodies used to incorporate between 30 and 40 sound-absorbing bitumen pads. Because the modern plastics now employed as underbody coatings also absorb noise and vibrations, some of these pads can be dispensed with, resulting in additional weight savings.

### Lighter gauge sheet metal

At the high temperatures at which spot welding is carried out, a phase transformation occurs in the metal. The metal panels used for autobodies must therefore be of a certain minimum gauge. High-strength epoxide adhesives, on the other hand, cure at low temperatures and do not weaken the metal. This allows the use of thinner body sheets.

Interior trims used to be secured to the vehicle body by means of ►solvent-based adhesives. Today, hotmelt adhesives are increasingly employed. These hotmelts set immediately upon cooling, thus reducing application cycle times. Moreover, the environmental impact caused by the use of solvents is eliminated.

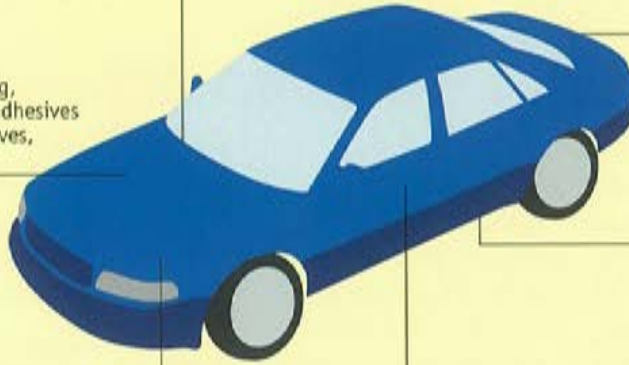


## Environmentally compatible developments in adhesives and anti-corrosion products Henkel automotive technologies

### Windshields and windows Bonding and sealing

**Engine compartment**  
Seam sealing, component sealing, cooling lubricants, hem-flange adhesives and sealants, anti-flutter adhesives, cavity conservation wax

**Body**  
Zinc phosphating



**Trunk area**  
Repair of plastic body components, sealing, cavity conservation wax

**Underbody**  
Underbody coating, acoustic coatings

**Doors**  
Hem-flange adhesives and sealants, anti-flutter adhesives, acoustic coatings

Earlier adhesives had to be cured in drying ovens to ensure that they were not washed out from between body components during cleaning and rinsing. The new generation of rubber-based adhesives is resistant to this washout effect. This eliminates the curing process, saving time and energy.

The development of environmentally compatible anticorrosion products has for many years been one of Henkel Surface Technologies' main priorities in the field of autobody surface treatment. Providing autobodies with long-term protection against corrosion necessitates several pretreatment steps. The most important of these is zinc phosphating.

A thin crystalline phosphate layer is applied to the metal surface. The crystals grow on the metal, imparting a silky-gray shine to its surface. To ensure a more regular crystal growth, phosphating is preceded by an "activation" process, in which many small "seed" crystals are applied to the surface. The additional use of ▶nitrite-containing accelerators speeds up the growth of the phosphate layer. How-

ever, ▶nitrous gases can form during this process under sufficiently adverse conditions. This risk has now been eliminated by the introduction of a new accelerator product, ▶hydroxylammonium sulfate (HAS), which allows automotive manufacturers to perform this conversion treatment without any need for expensive vacuum extractor systems.

### Modern accelerators cut hazardous waste volumes

When iron is subjected to phosphating, this is usually accompanied by the formation of iron phosphate sludge, which also contains zinc phosphate. Modern accelerating agents do not cause excessive formation of poorly soluble phosphates, thereby helping to reduce hazardous waste. Today's phosphating baths produce optimal results, even though bath temperatures have been reduced by around 10°C. The energy consumption in the automotive manufacturing process is thus decreased further.

Some gaps remain between the zinc phosphate crystals on the autobody

surface, and these are usually filled with poorly soluble ▶chromium salt precipitates in a ▶passivation process. Chromium has by now been replaced by much less hazardous components, such as ▶zirconium fluoride. Over the last 10 years, the wastewater discharged from the cleaning sections has dropped from three to just one cubic meter per autobody.



Autobody pretreatment: the phosphating step is important for the adhesion of the subsequently applied paint, and as an anticorrosion measure.



**Health.** Henkel has always taken health protection very seriously, considering it a part of its responsibility as a manufacturer. Under the ►Responsible Care program, health protection forms an integral element of the Group-wide SHE Management System (Safety, Health, Environment), which is scheduled to be implemented by the end of 1997 (see page 7).

## Consumer Service – A Good Reputation

Nothing can strengthen a company's reputation more effectively than openness. This was recently confirmed by the Cospha unit of Henkel's Chemical Products management sector, when it set up a new consumer service for customers from the cosmetics industry. The service includes comprehensive product documentation. Detailed data on ►toxicological and ►dermatological properties, quality control, and undesirable by-products and impurities can be called up on-line. Cosmetics industry customers receive this information upon request. The product data are particularly impor-

tant for customers within the European Union (EU). Under the provisions of the 6th Amendment to the EC Cosmetics Directive, they are required, effective 1997, to compile a detailed file for each product.

### Safety assessments for more than 100 ingredients

Cosmetics formulated from various raw materials are subjected to an initial assessment based on the data of the individual components. As part of this service project, for which preparatory work has been carried out by the Biological Research and Product Safety Department since

1994, Henkel toxicologists have compiled safety evaluations for over 100 cosmetics ingredients. Gaps in the data have been systematically closed.

### Generally recognized scientific standards

The new service facilitates the compilation of product safety assessments by cosmetics manufacturers. The assessments conform fully to the generally acknowledged safety standards for cosmetics and can therefore be used anywhere in the world.



Tests being carried out on cell cultures to ensure that cosmetics ingredients from Henkel have no toxic or mutagenic effects.

**Cosmetics ingredients**  
**More information**

Under European Union directives, each quality or safety assessment of cosmetic consumer products must include information such as the following:

- complete analysis of the component substances;
- ►toxicological and ►microbiological evaluation;
- evidence of effectiveness;
- ►Good Manufacturing Practice; and
- documentation.

Henkel has taken the system one step further by offering its cosmetics industry customers ►dermatological assessments of product constituents as well.





Where animal fats are handled in oleochemical production processes, as in this Düsseldorf facility, high temperatures and pressures effectively rule out any BSE hazard.

Extreme production conditions

### No chance for BSE pathogens in fats

Henkel is the world's largest processor of natural oils and fats. Production processes rely mainly on vegetable raw materials from sources such as coconut trees, sunflowers, rapeseed, corn and potatoes. For some specialty products, animal fats are used. These raw materials, active ingredients, and finished products present no ►BSE hazard. The Chemical Products business sector has installed a control system that ensures that only raw materials from so-called "low risk" countries are used. All suppliers must be able to certify the origin of the fats they deliver. In compliance with European regulations, this procedure ensures that animal fats from Great Britain and Switzerland are not introduced into the production chain.

Moreover, Henkel uses extreme production conditions (temperatures up to 300°C, pressures up to 250 bar), which, to the best of current scientific knowledge, allow full control of any potential BSE causative agent, even if

material from "high risk" sources should enter the process.

The risk assessment model for medical products, established by the Bundesinstitut für Arzneimittel und Medizinprodukte (German Federal Institute for Pharmaceutical and Medical Products), was meticulously applied to all Henkel products whose raw materials include animal fats. The results showed that the conditions prevailing during animal fat processing at Henkel are far more exacting than all current requirements on medical products.

Through the use of these extreme processing conditions and its highly selective raw material procurement system, Henkel is able to ensure that, according to the latest scientific knowledge, its products based on animal fats do not pose a risk to the consumer.

New mucous membrane antiseptic

### All good things come in threes

Three highly effective compounds, ►ethanol, ►hydrogen peroxide, and ►chlorhexidine gluconate, are the main constituents of a new mucous membrane ►antiseptic developed by Henkel-Ecolab. The new antiseptic is tolerated much better than conventional disinfectant preparations. Disinfectants (antiseptics) combat infections and/or prevent them from spreading.

Mucous membrane antiseptics constitute a particularly sensitive area. According to one US study, urinary tract infections account for 40 percent of all infectious disorders contracted in the hospital, closely followed by wound infections (25 percent) and infections of the respiratory tract (16 percent).

The new mucous membrane antiseptic presented by Henkel-Ecolab's hygiene experts is a combination of proven substances, whose individual effectiveness has been demonstrated

in many years of clinical practice. Taken together, their potency is unsurpassed. Their activity profiles supplement each other to give a broad spectrum of effectiveness, e.g., against bacteria, fungi, yeasts, AIDS pathogens, and herpes simplex viruses. The risk of developing a resistance to antiseptics is virtually reduced to zero by this triple combination.

As a quick-acting, gentle, and safe medicine (approved as a drug in January 1996), the new mucous membrane antiseptic covers all fields of application.

Unlike comparable iodine preparations, which were previously used alongside alcohol for antiseptic treatment, the new product is very well tolerated. It also takes effect very quickly: all test strains were destroyed within 30 seconds. Even repeated ►contamination with spores does not reduce its inherent sterility – an important attribute in the day-to-day rush of doctors' offices and hospitals.

### Poison control helpline New 24-hour service

A special consumer telephone helpline (+49-0)211-7970) has been set up to provide 24-hour specific assistance in toxicological emergencies involving Henkel products. The service covers all Henkel products, from detergents and adhesives to metal chemistry products and cosmetics.

The availability of this type of service is by no means the norm outside the detergents, household cleansers, and cosmetics industry. The helpline staff comprises Henkel ►toxicologists and company physicians. They have access to a wide range of safety-related product data, from formula components to toxicological information.



# Production

Site reports indicate that many problems of a similar nature are being tackled within the Henkel Group. Technology transfer and a lively exchange of experience between sites ensure far-reaching synergetic effects in the improvement of environmental protection and safety at the production level.



Henkel's production processes must be safe for its employees and its neighbors, and for the environment as well. Sophisticated safety systems and well-trained, environmentally aware employees ensure that this objective is achieved. The picture shows a facility in Düsseldorf's "oil quarter."



**Henkel around the globe.** At all Henkel Group sites, managers and employees work diligently to enhance the Company's environmental, health and safety protection performance. Numerous examples on the following pages illustrate what is currently being achieved at the production level and show how creativity and innovativeness produce smart solutions. The improvements described are arranged by regions and countries.

## Many steps toward the same goal

**A Henkel Austria.** Vienna is the headquarters and one of the production sites of the Henkel Austria Group. Its products include detergents and household cleansers. In addition, Henkel Austria is responsible for all of Henkel's activities in central and southeastern Europe, including production plants in Hungary, Poland, Slovenia and Slovakia.

### Recycling plant

#### Plastics reborn

**Vienna.** In 1992, Henkel Austria commissioned a plastics recycling plant. Its intended purpose was to handle the recycling of the polyethylene bottles used for Henkel's cleansing and body care products. It was soon found that it is worthwhile to process more than the company's

own plastic waste. Today, large quantities of used and empty plastic bottles and containers are collected by the municipality and brought to Henkel Austria for recycling.

This form of cooperation has proven to be very successful. The plant can handle 1,000 metric tons per year and is operating to near capacity. In 1996, Henkel Austria produced 871 metric tons of plastics recyclate from the discarded containers.

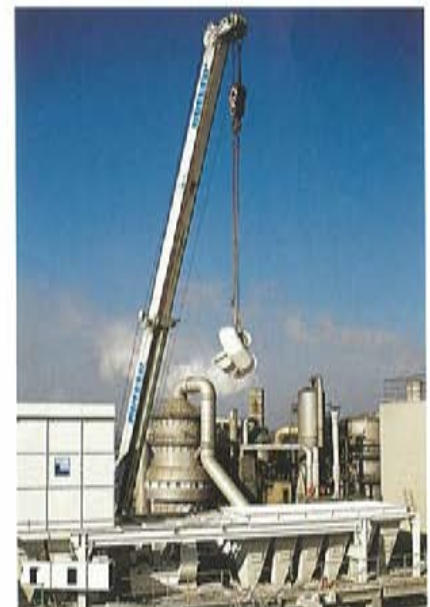
The target set by the Austrian Packaging Materials Ordinance for the year 2000, i.e., an 80-percent recycling rate, is already being met today. Some of the recyclate is used in-house by Henkel. Most of it, however, is sold to customers who use the material to manufacture new components such as plastic pipes.

**D Henkel KGaA.** In 1899, Fritz Henkel moved the company he had established in 1876 at Aachen, from Düsseldorf-Flingern to what was then the suburb of Holthausen. Today, this is the home of Henkel's Group headquarters and constitutes its largest production site, where almost 9,000 employees are engaged in research, development, engineering, marketing, sales, administration, logistics and production. Business sectors with production facilities in the parent plant include Chemical Products, Industrial Adhesives/Technical Consumer Products, Detergents/Household Cleansers, and Industrial and Institutional Hygiene.

### Exhaust air filters

#### Dust swallowers

**Düsseldorf-Holthausen.** The powdered detergents plant received a new exhaust air filter system in the spring of 1996. These so-called "jet filters" are characterized by the considerable efficiency with which they remove dust from exhaust air.



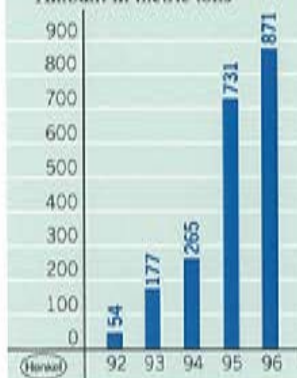
A crane positions the new filter system in the detergents plant.

The level of residual dust in the exhaust air is well within the legal limits. A continuously operating dust measurement system monitors the operation of the filters to ensure constantly high effectiveness. The recovered detergent dust is not discarded, but is fed back into the production process.

#### Recycled plastic packaging

Henkel Austria, Vienna

Amount in metric tons





Less nickel in wastewater

## Rapid success in the oil plants

**Düsseldorf-Holthausen.** Many technical applications require natural oils, ►fatty acids, and their derivatives to be hardened, a process chemists refer to as ►hydrogenation. This is achieved with the help of nickel ►catalysts. Hydrogenation is performed in batches, using specially designed reactors. With every changeover to another product, a rinse cycle is necessary, during which small amounts of residual catalyst are flushed out. The wastewater therefore contains nickel. Although various measures taken in recent years have allowed the nickel load to be stabilized at a very low level, a slight upward trend has now been detected. To enable selective measures to be taken to reduce the nickel content of the wastewater, a nickel register was compiled. This contains information on the contamination of the wastewater from the individual plants and also on how the nickel load varies over time.

### Nickel loads in wastewater

Henkel parent plant, Düsseldorf

Average daily load in 1996  
in kilograms



A world first in the Düsseldorf "oil quarter": the continuous fatty acid hydrogenation facility.

It was found that relatively high nickel loads occurred only at very specific locations, and, due to the batch production procedure, only at very specific times. Thanks to a newly developed, fast, on-site method of analyzing nickel, all polluted wastewater from the oil plants can now be identified and separately collected for further treatment in a nickel precipitation facility.

This reorganization step has led to another substantial reduction in nickel loads in the site's wastewater. The outcome demonstrates that it does not always take a new plant or a major upgrade to achieve environmental progress; sometimes a change in procedure will work just as well.

Continuous hydrogenation

### Precious-metal catalysts

**Düsseldorf-Holthausen.** Henkel has adopted a new solution for the large-scale production of hydrogenated fatty acids. Its investment in an advanced, environmentally compatible, large-scale, continuous plant proved to be truly worthwhile. The new, continuous hydrogenation process no longer uses a nickel catalyst, but – and this is a first with fatty

acids – a noble metal instead. This has the advantage that, although it also needs to be replaced after many months of operation, it can subsequently be directly reused, after being subjected to a special treatment. Product changeovers are now only rarely accompanied by rinsing, and, in any case, the design and physical nature of the catalyst are such that it is no longer flushed out.

The new plant is a good example of integrated environmental protection. The continuous system, with its hydrogenation, distillation, and ►deodorization sections, replaces the previous successive batch processes. The automatic operation of the plant, backed by a systematic maintenance schedule, results in a very high level of plant reliability.

In recognition of the ecological and economic benefits of the process, the development team received the Fritz Henkel Award for Innovation.

Special fuel

### Waste to energy

**Düsseldorf-Holthausen.** Reaction processes in the oleochemical plants yield ►amine-containing ►methanol as a waste product. As this residual



material contains up to 15 percent by weight of amine, it was not suitable for reuse in the plant. External disposal was the only solution.

Following a detailed analysis, however, Henkel process engineers have now changed the reaction process so as to obtain methanol with an amine content of less than 2 percent by weight as residual material.

Not only does the improved reaction control technique offer the advantage of a significantly reduced amine input, but the residual material, i.e., methanol, can be directly used as fuel for Henkel's power plant, thereby completing the waste-to-energy cycle.

Fatty alcohol plants

### Layered steel chips

**Düsseldorf-Holthausen.** A process developed in Henkel's ►fatty alcohol production plants to remove zinc and copper from wastewater was described in the 1994 Environment Report. A copper/zinc separating

system was exhaustively tested in a comprehensive series of laboratory trials. The plant uses an "electrochemical" process, whereby copper and zinc are deposited on iron chips. When the production-scale plant was erected, however, it turned out that the good results obtained in the laboratory could not be reliably repeated. Process engineers are familiar with this "upscaling" effect. In this case, different flow conditions in the small laboratory system and the full-size production plant were responsible for the difficulties.

Process experts pondered over the problem long and hard before they were able to come up with a specific multilayer arrangement of steel chips in various sizes and shapes. Together with the use of variable displacement pumps, this approach improved the flow conditions in the full-scale system so much that the copper and zinc levels in the purified wastewater are now far below the specified thresholds.

Recycling surfactant wastes

### Clean solution

**Düsseldorf-Holthausen.** In the ►sulfation facilities at Henkel's parent plant, the production of ►surfactants for detergents yields viscous wastes that contain large amounts of ►organic oleochemicals. The ►chemical oxygen demand (COD) of these surfactant wastes was too high to allow them to be channeled into the wastewater sewer system, and they had to be disposed of by more expensive means. Henkel's waste experts were no longer satisfied with this state of affairs. They embarked on a search for a more environmentally compatible and cost-efficient solution.

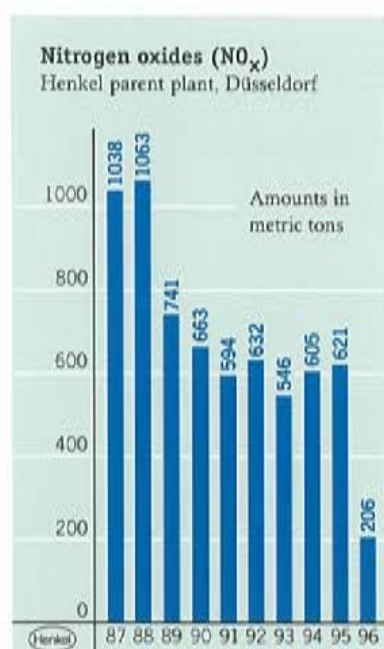
As a first step, surfactant wastes with a high calorific value are incinerated in the Company's own power plant, i.e., they are thermally reutilized. It was thought that the remaining wastes, of low calorific value, could then be ►aerobically or ►anaerobically biodegraded. In cooperation with the City of Düsseldorf's Kanal- und Wasserbauamt (Hydraulic Engineering and Sewers Authority) and the Henkel subsidiary, COGNIS Industrial Consulting, the Company's chemists and engineers set out to determine which of the two was the more appropriate route. In early 1996, laboratory trials and pilot tests were carried out at the Düsseldorf South sewage treatment plant, where about 11,000 cubic meters of wastewater from Henkel's parent plant are treated every day, to find out whether the surfactant wastes could be aerobically degraded by channeling them selectively into the biological treatment stage. The results failed to convince the experts. ►Carbon dioxide and large amounts of ►biomass were generated in the aerobic section of the sewage treatment plant, i.e., the activated sludge tank (which required considerable amounts of energy for aeration), and had to be disposed of in the digester. The engineers therefore focused on anaerobic

### Water glass production plant

#### Substantial reduction in nitrogen oxide emissions

**Düsseldorf-Holthausen.** As described in the 1996 Environment Report, the water glass factory was fitted with an exhaust air cleaning system in late 1995, to substantially reduce ►nitrogen oxide ►emissions. The system was started up without technical problems and operated smoothly all through 1996. The new equipment reduces nitrogen oxide emissions by over 60 percent.

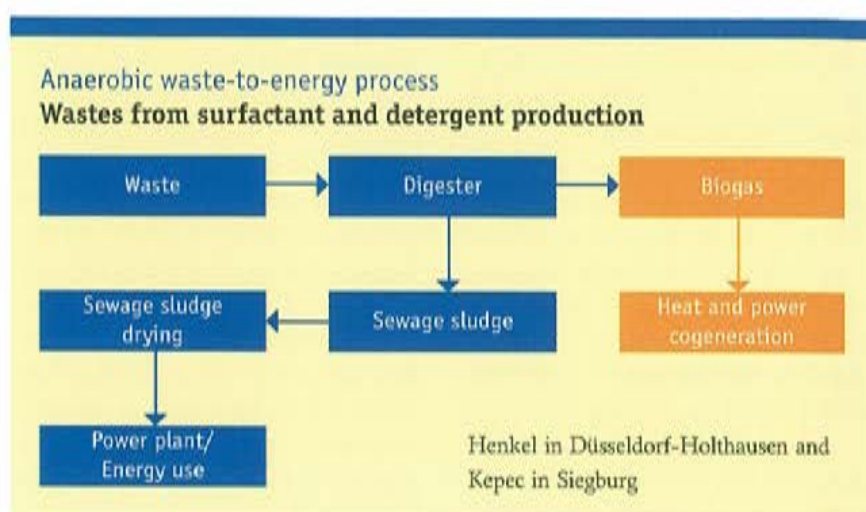
►Water glass is one of Henkel's oldest products and is used mainly as a raw material for ►precipitated silica and detergents, and in the synthesis of ►zeolite A, a ►phosphate substitute.





biodegradation. They started out with a theory derived from a life cycle assessment of detergent components by COGNIS Industrial Consulting. This had shown that the direct anaerobic biodegradation of surfactants in the digesters of sewage treatment plants can generate energy. The laboratory results were very convincing, too, showing that surfactant wastes in the sewage sludge promote the production of gas in the sludge fermentation process. Over 90 percent of the energy contained in the surfactant wastes can be utilized.

The practical implementation of this effect is currently being studied in a long-term trial, which started in March 1996, involving the three digesters of the Düsseldorf South sewage treatment plant. The anaerobic biodegradation process mainly produces biogas (methane), with only small amounts of biomass. The biogas is used as a source of energy for generating steam. The steam is, in



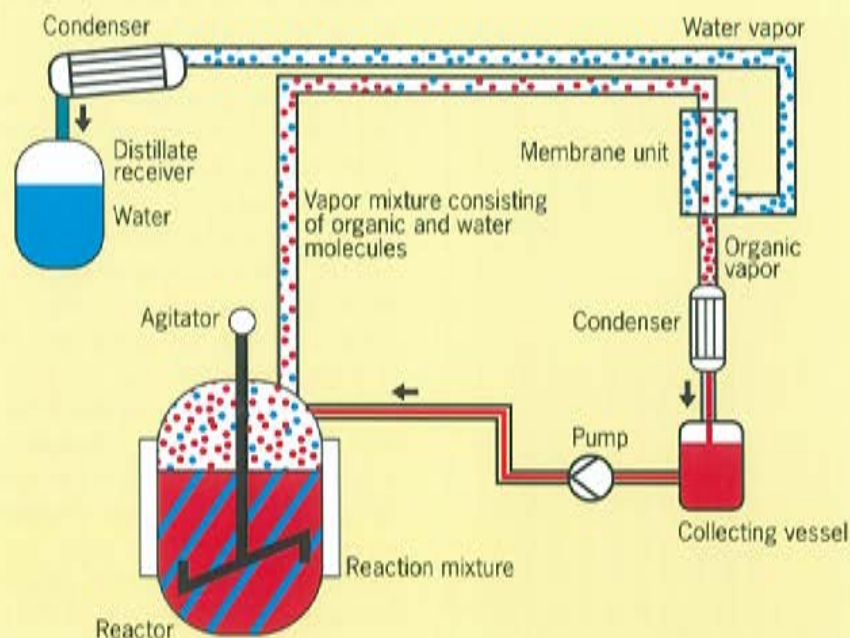
turn, needed by the sewage treatment plant for drying the sewage sludge to produce high-grade fuel.

Reviewing the interim results of their cooperation, the Hydraulic Engineering and Sewers Authority and Henkel feel encouraged by the project. The new disposal method brings nothing but benefits to the two partners and to the environment. The environmental

impact formerly associated with the transportation of surfactant waste can be reduced by as much as 80 percent.

In addition, the method eliminates the need to evaporate the high water content (approx. 90 percent) of the surfactant wastes through added energy input in the incinerator – another effect which will benefit the environment and conserve natural resources.

### Kepec Chemische Fabrik Membrane process



### D Kepec Chemische Fabrik

Kepec, located in Siegburg near Bonn, employs about 80 people. It produces organic specialty chemicals from renewable raw materials. These products are used in coatings, auxiliary agents for the leather and textile industries, cosmetics, body care products, detergents and cleansing agents, household cleansers, etc. Some of these products are subjected to further processing within the Henkel Group.

Avoiding waste

### Smart membrane

**Siegburg.** Many of the chemical syntheses carried out at Kepec result in the formation of water during the reaction process. This water must be removed from the reagent mixture in order to achieve high yields and make optimal use of the raw material feedstock. Since a straightforward separa-



tion by distillation was not feasible in the case described here, the water was removed with desiccants. The used desiccant formed a waste material, which also contained fairly high concentrations of ►organic matter. The problem was that this material had to be specially treated and disposed of. A solution was found in the form of a newly developed ►membrane technology.

The vapor phase over the hot reaction mixture, in which the water vapor accumulates, is now channeled through a membrane unit. The membrane permits water molecules to pass through, but remains impermeable to organic molecules. The water is thus "filtered out" and is the only substance that has to be disposed of. The organic components of the vapor phase are condensed downstream of the membrane unit and fed back into the reactor. In this way, no raw material is lost.

This new method reduces the amount of waste produced. For the company's employees, there is an additional benefit in that all desiccant handling processes are eliminated, and the process takes place in a fully closed cycle.



Kepec, Siegburg, built a new raw material batch storage facility in 1996.

#### Life cycle assessment

#### Anaerobic treatment generates energy in the digester

**Siegburg.** Henkel's subsidiary, Kepec, has benefited from Düsseldorf's experience in the disposal of wastewater with high ►COD levels. Kepec's wastewater has COD levels of up to 150 grams per liter. A life cycle assessment performed by COGNIS Industrial Consulting shows that, per tank truck (25 metric tons) of Kepec wastewater, ►anaerobic processing in the di-

gesters of a sewage treatment plant will produce between 25 and 30 ►gigajoules of energy, whereas ►aerobic biodegradation, rather than generating energy, will actually consume some 8 to 10 gigajoules (e.g., to drive the aeration system). In view of this clearly superior energy balance, the specialty chemicals manufacturer has decided in favor of the anaerobic treatment route.

This technique was perfected by the process engineering development unit of Henkel's Chemical Products business sector in Düsseldorf. The conversion of the production plant at Siegburg was preceded by extensive trials on a laboratory and pilot plant scale.

Kepec also puts safety first in regard to hazard prevention. This is evident in the design of the new raw materials batch storage facility, a warehouse used to store water-polluting substances. In Germany, these substances are divided into four categories (category codes 0 through 3). The Siegburg site handles substances in categories 0, 1 and 2. Products in the highest water-pollutant category (3) are stored only in minimal amounts. Nevertheless, the entire new storage area was designed to the category 3 specification.

Several different concrete layers, special sheeting, and a unique tank floor design ensure that, in the event of a spill or leak, chemicals will be prevented from penetrating into the soil, where they might also contaminate groundwater. Kepec has opted for maximum safety in its new installation.

**D Thompson-Siegel.** The Thompson-Siegel production site is located right in the middle of Düsseldorf and employs about 400 people. It manufactures liquid cleaning products for commercial and household use, in addition to products such as toilet deodorants, home plant fertilizers, and filler compounds for the construction industry.

Motivated staff

#### Reduced water consumption and fewer accidents

**Düsseldorf-Flingern.** In recent years, Thompson-Siegel has made a consistent effort to improve environmental protection and safety. Comprehensive measures have been implemented to reduce the company's wastewater output by well over 60 percent in the last six years.

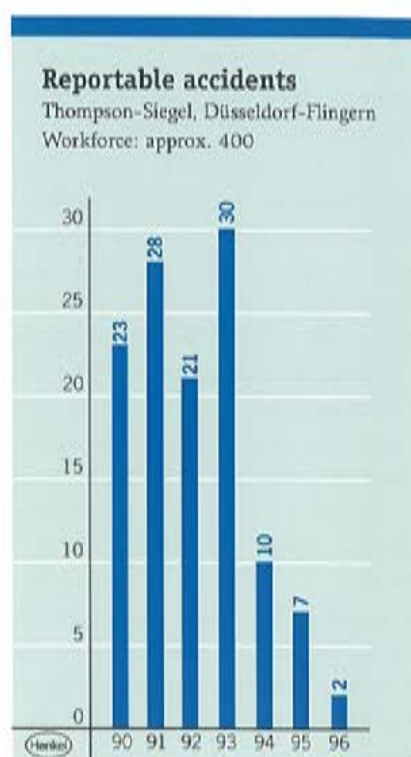
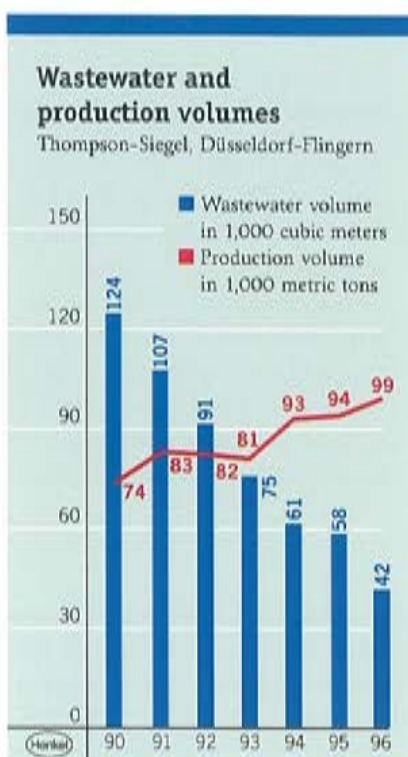
This was achieved by ingenious production planning, involving fewer rinse cycles and reduced rinse water volumes, as well as the installation of a system to demineralize cooling water for reutilization in the factory. Thompson-Siegel considers that these achievements would not have been possible without the high motivation of its employees, who have been sensitized to environmental matters by extensive information and training. Establishing a commitment to



accident prevention was a particularly important element. The defined target of "zero accidents" has indeed led to a change in employee attitudes. What else could explain the marked decrease in accident rates?

This change in awareness was decisively management-led. Thompson-Siegel supported its policy with a mandatory reporting system for the analysis of near-accidents, requiring immediate notification of top management.

Thompson-Siegel's main focus for 1997 is the subject of wastewater. Its goal is to reduce wastewater loads, especially their organic components.



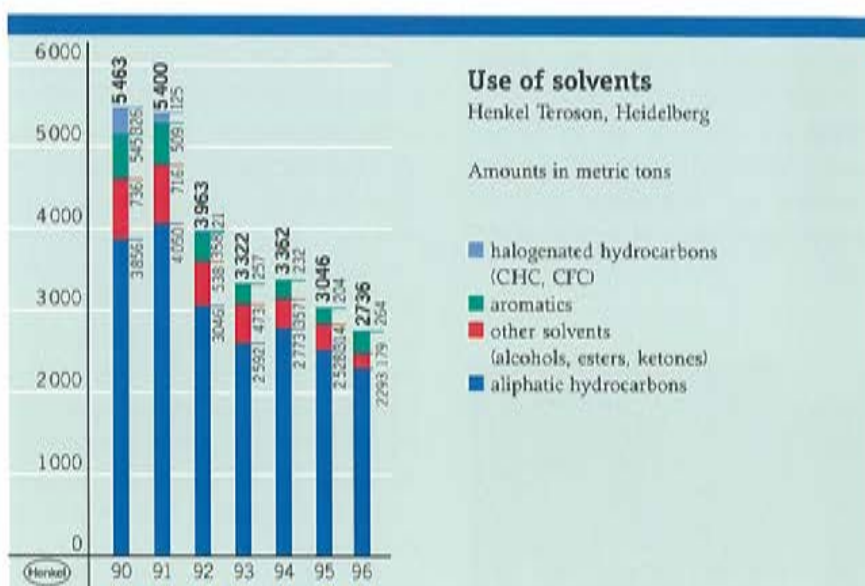
**D Henkel Teroson.** This Surface Technologies site is located in Heidelberg. Henkel Teroson handles a large part of Henkel's worldwide automotive industry business, manufacturing adhesives and sealants, as well as anticorrosion and noise-insulation products for the automotive industry, auto repair shops, and other industrial sectors. The Heidelberg company employs 800 people.

Reduced solvent consumption

### Step by step

**Heidelberg.** The conservation of resources and improved environmental protection have been an ongoing concern at Henkel Teroson for many years. A creative and highly motivated workforce has implemented many effective measures, adding up to an impressive improvement record. All departments at Henkel Teroson have contributed to this success.

The Product Development and Application Technology unit of the Heidel-



berg-based company has gradually shifted the company's broad product range from traditional chlorinated hydrocarbons (last used in 1992) to low-solvent and water-based formulas. This has not only reduced the amount of solvents used, but has also led to a decrease in the organic gaseous emissions associated with the production process. Additional measures, such as the installation of

exhaust air purification systems and the increased use of closed production cycles, have enabled the company to reduce its organic gaseous emissions from 170 metric tons in 1990 to 11 metric tons in 1996.

At the same time, Henkel Teroson has been able to decrease its power and water consumption through improved manufacturing processes and numerous engineering adjustments.





The new wastewater treatment plant in Barcelona has reduced COD loads.

**E Henkel Ibérica.** Located in the Zona Franca industrial area south of Barcelona, Pulera, a subsidiary of Henkel Ibérica, produces ►surfactants, ►fatty acid esters, and other basic oleochemicals. The plant workforce numbers 140. In Montornès, also near Barcelona, the company makes powdered and liquid detergents, adhesives, and oleochemical products, as well as edible fats. A total of 450 employees work at this site.

COD loads reduced

### Optimized operation, reduced water demand

**Zona Franca.** Although the physico-chemical wastewater purification plant which went into operation in 1995 (see 1996 Environment Report) has significantly reduced ►COD loads, Pulera is not yet satisfied. To optimize control of the wastewater treatment, the company's experts are planning to install new analytical equipment to monitor COD loads at the inlet and outlet of the treatment plant at short intervals. This will allow them to optimize the operation of the wastewater treatment plant, with the aim of

achieving another 30 percent reduction in COD by late 1998.

The project team has also investigated in-house water consumption. More efficient organization of processes and cleaning stages has reduced the use of rinsing water.

These improvements have not only cut down water demand, but also decreased wastewater volumes. Moreover, partial recycling of rinsing water into the production process reduces the overall volume of wastewater. In 1997, Pulera is determined to reduce its water consumption by an additional 10 percent.

Another important objective at Zona Franca is to arouse and encourage employee awareness of waste prevention. Over a period of three months, all members of the workforce received extensive training in waste management. The program included information on the classification of various waste types, marking and packaging, as well as proper storage and transportation. This intensive training has already resulted in a marked reduction in waste volumes, achieved through many small steps.

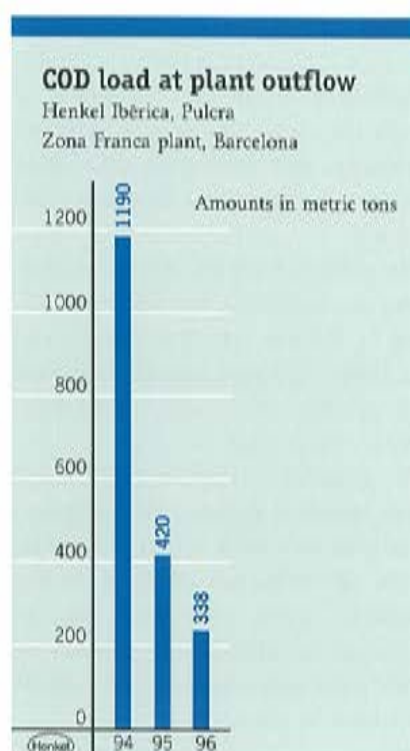
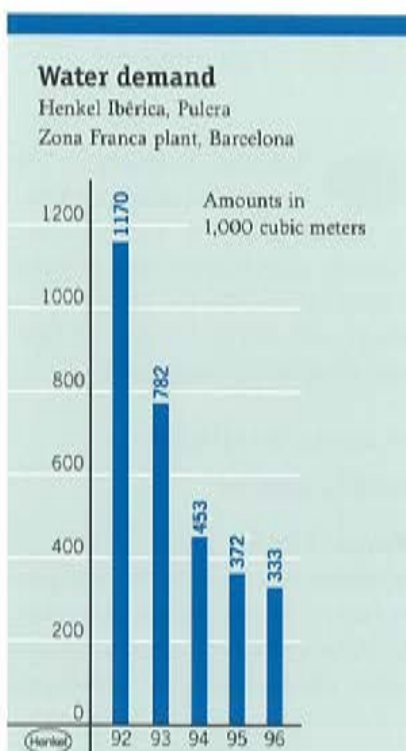
Detergent production

### Rinsing water channeled into buffer tanks

**Montornès.** Rinse water from the production of detergents is characterized by high ►COD loads and constitutes a major factor in wastewater pollution. Company experts therefore sought to identify potential improvements. Today, this rinse water is no longer discharged into the wastewater, but is collected in two buffer tanks. From there, it is selectively fed back into the production cycle. This approach has enabled Montornès to achieve an annual reduction in COD loads of 100 metric tons.

Despite this success, the Montornès team is determined to continue its intense efforts to improve wastewater quality. In particular, it intends to analyze and characterize the very different wastewater types from various production sectors, as part of a special program that will enable the company to initiate suitable measures to reduce wastewater loads.

Water consumption rates have also been improved. The installation of





a new cooling tower with a cooling water return circuit has enabled the oleochemical plant to reduce its water requirement by approximately 25 percent.

**F Henkel France.** The town of Nemours is situated about 100 kilometers south of Paris. At this site, Henkel France produces liquid detergents and bleaching agents, as well as dishwasher cleansers. The Nemours plant has about 150 employees. In Ponthierry, halfway to Nemours, some 120 employees produce liquid detergents, dishwashing detergents, fabric softeners, and bleaching agents. At the Lièpvre site in Alsace, Henkel France manufactures cosmetics and toiletries. About 100 people are employed here.

#### Recycling system

#### Closing the loop

**Nemours/Ponthierry.** These two sites pursue a common objective. They are determined to prevent or recycle waste, instead of merely disposing of it. The plant managers at Nemours and Ponthierry are well aware that this cannot be accomplished without a creative and highly motivated workforce. Programs at both sites have therefore focused on training and seminars addressing waste separation and recycling techniques.

The goals defined by the two companies are ambitious, but differ according to the site specifics. By the end of 1998, Nemours intends to recycle 10 percent of its waste, and Ponthierry 60 percent.

The program for paper and cardboard was launched in late 1996. Employees plan to return some 150 metric tons of cardboard products to the material cycle each year via an external recycler. In the summer of 1997, the recycling program will be extended to plastics.

#### Wastewater purification

#### Modular system

**Lièpvre.** Wastewater streams at Lièpvre contain varying pollutant loads. Up to now, those containing the highest pollutant levels have been collected and shipped to an external disposal facility. The remaining wastewater was discharged without receiving any prior biological treatment – certainly not a long-term solution. The management at Lièpvre therefore decided to install a wastewater treatment plant.

The special feature of this plant is that it consists of several containerized modules, operating in parallel. This design allows for easy future expansion in response to production growth.

The biological stage of the plant is capable of handling wastewater with very high ►COD levels, as demonstrated in a four-month pilot test. After the plant had been taken into operation, it was optimized further, achieving near-complete biodegradation of ►surfactants and bringing COD levels to below the legal threshold. An additional ozone treatment stage ensures that the company's wastewater is fully decolorized.

**F Sidobre-Sinnova.** The French subsidiary of Chemical Products, Sidobre-Sinnova, manufactures oleochemical and technical products at its Meaux site, 40 kilometers east of Paris. It has a workforce of about 140 employees.

#### Ethylene oxide tank farm

#### Doubly secure

**Meaux.** Ethylene oxide (EO) is an important raw material for the production of ►nonionic ►surfactants. An inflammable, toxic gas at atmospheric pressure, EO is transported and stored in liquified form under

pressure and must be handled with great caution. The EO tank farm at Meaux, like its equivalent at Fino Mornasco, in Italy (see page 36), was therefore included in the Group-wide study of hazard potentials. Although the analysis identified no unreasonably high risks for the Meaux site, the installation of modern safety equipment at certain points was recommended. Sidobre-Sinnova was not content with this retrofit solution, however, and opted for the erection of an entirely new tank farm at Meaux.

A project of this type requires the approval of a number of different authorities, prior to which the plans must be made available for public inspection. The neighbors' questions were answered in detail, and all concerns dispelled. An exhaustive safety study prepared by an independent engineering firm provided additional reassurance. All potential scenarios, including highly improbable ones, such as an earthquake or explosion in the vicinity, were included in this analysis.

The safety concept for the tank farm proved reliable even under such extremes, not least because a comprehensive set of safety measures had been adopted. The tanks are half-buried in the ground. Each tank has a double cooling shell, in addition to a fire insulation layer. The tanks stand in thick concrete troughs that prevent ►emissions into the soil. Gas detectors at many points in the installation register the slightest leak and set off an alarm, causing all valves to close automatically. If an accidental release of ethylene oxide should nevertheless occur, a sprinkler system can generate a fog of fine water droplets to smother the gas cloud.

The safety of the plant is further enhanced by the low storage temperatures. All key safety systems, such as shutoff valves, are installed in duplicate, to provide the appropriate





The new ethylene oxide tank farm at Sidobre-Sinnova in Meaux is equipped with sophisticated safety systems.

backup capability in the event of a component failure.

Operating procedures at the new tank farm are also more environmentally compatible. Ethylene gas forced out while the tank is being filled, for example, is not emitted into the atmosphere, but passed through a set of gas scrubbers. These scrubbers also absorb the EO-rich exhaust air from the production plants, thus preventing emissions from these areas as well. The gas scrubbers convert the ethylene oxide into glycol, a dihydric alcohol, which is then reutilized. Glycol is a traditional antifreeze additive for automotive cooling fluid systems.

**I Henkel S.p.A.** In Lomazzo, a small town south of Como, Henkel's Italian subsidiary operates a production site for liquid detergents. Its workforce comprises about 200 employees. Not too far away, again south of Como, is the Fino Mornasco site, with 100 employees, who produce oleochemical base materials for the detergent and cosmetics sectors, as well as auxiliary agents for the leather and textile industries. The plant at Ferentino, situated halfway between Rome and Naples, manufactures powdered detergents. It has a workforce of around 260 people.

Closed loop

### Reduced water consumption in production

**Lomazzo.** The overall growth in production in recent years, and the increased output of liquid concentrates in particular, have brought about changes in the characteristics of the wastewater at the Lomazzo site, especially in regard to ►organics. This trend is reflected in the rise in the ►COD values of the site's total wastewater.

The wastewater from individual production sections was analyzed in the context of a study carried out in 1990. However, subsequent changes in the manufacturing processes have invalidated the results. In 1996, the company conducted a new, systematic analysis of the individual substances responsible for the site's COD levels. Concluded in December 1996, the study now forms the basis for the development of a COD load reduction program.

The study showed that over 70 percent of the total organic wastewater load are attributable to cleansing processes. Improvements in these processes are currently being investigated.

The experts at Lomazzo are also determined to make substantial headway in reducing the amount of water required in production. Through the installation of cooling systems with closed water cycles, the total water consumption is to be reduced by 150,000 cubic meters by 1998, i.e., half of the current level.

Workplace noise levels

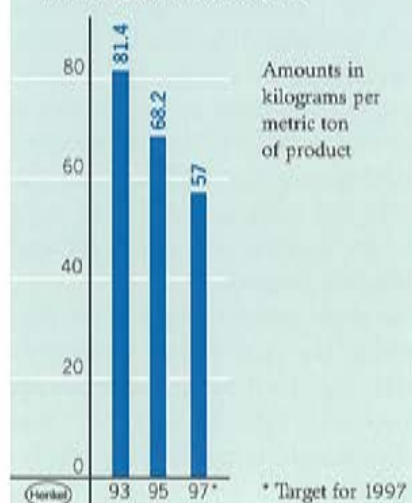
### The exception rather than the rule

**Ferentino.** A European Union directive imposing new limits on workplace noise levels prompted the Ferentino site to conduct a systematic analysis of the noise levels in individual workplaces in its detergents plant. The study identified five workplaces where employees were exposed to noise exceeding the limits specified in the directive. At the very least, these findings necessitated the implementation of noise abatement measures, together with occupational health monitoring of the affected employees. However, this did not go far enough for the Ferentino plant managers, who drew up and implemented a comprehensive noise abatement program covering all work areas. Thanks to a raft of engineering and organiza-



### Amount of packaging materials used

Henkel S.p.A., Ferentino plant



tional measures, workers in production are now exposed to significantly less noise. The boiler house, for instance, was fitted with new low-noise fans, and several workplaces were relocated to noise-insulated areas. Air compressors with noise damping helped to bring down noise levels still further.

Work processes have also been reorganized, so that personnel are now only exposed to high-noise environments during special tasks and for limited periods of time. Maintenance sessions are now carried out only when machinery has been shut down. Some production improvements were based on the past experience gained by Düsseldorf experts.

Ferentino's efforts to conserve resources are focused on the packaging of its detergents. The amount of packaging material, already reduced by the switch from drums to cartons, was cut still further by the introduction of refill bags. This step has resulted in substantial savings in packaging materials.

### New wastewater treatment plant Performing to expectations

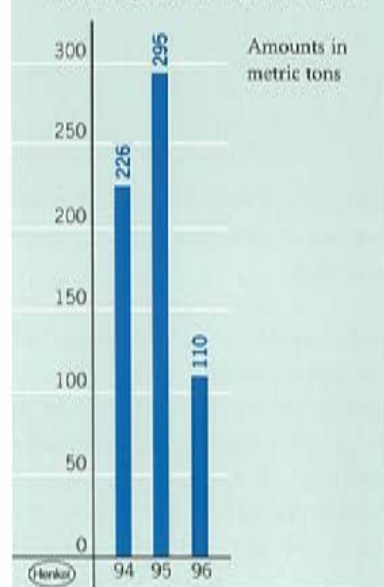
**Fino Mornasco.** A new biological wastewater treatment plant has been in operation at the Fino Mornasco site since January 1996 (see 1996 Environment Report). The plant performed as efficiently as expected, without any initial difficulties. ► Surfactants undergo at least 80 to 90 percent biodegradation. The overall ► organic wastewater load is reduced by a minimum of 70 percent. The plant's wastewater is not discharged directly into surface waters, but is channeled into the municipal sewage network, before undergoing further purification in the municipal sewage treatment plant.

Following the 1995 modernization of the ► ethylene oxide tank farm, which was equipped with the latest safety technology (see 1996 Environment Report), the site management has made further efforts to enhance the safety of its ethoxylation operations. A newly installed process control system provides still more accurate monitoring of the

reaction process and can respond even more quickly to changing production conditions. All important data are transmitted directly to the control room.

### COD loads in the plant outflow

Henkel S.p.A., Fino Mornasco plant



**PL** **Henkel Polska.** Henkel Polska belongs to the Henkel Austria Group. At Raciborz, a major town on the Oder River in southern Poland, the company produces powdered detergents, soaps, and ► sulfonic acids. This Henkel plant has a workforce of about 270 employees.

Detergent filling operations

### Filtering the dust

**Raciborz.** Ever since this site became part of the Henkel Group in 1991, its technology has been consistently improved and updated to the latest standards. This also applies to its environmental engineering systems. A rigorous reduction in the site's dust ► emissions had already been implemented in the early 1990s. Dust loads at workplaces in the detergent

filling line were significantly decreased by a newly installed extraction system. The dust is trapped by fabric filters, collected, and fed back into the production process.

Current plans call for conversion of the site's power plant to natural gas, to achieve a further reduction in atmospheric emissions.

**TR**

**Türk Henkel.** Izmir is Turkey's third largest city and an important commercial port on the Aegean Sea. At this site, Türk Henkel produces liquid and powdered detergents, as well as edible fats. The plant has around 280 employees. At Cayirova near Gebze, in the European part of the country, Türk Henkel man-



ufactures ►organic specialty chemicals, auxiliary agents for the leather and textile industries, metal treatment products, industrial adhesives, and auxiliary products for the commercial and private construction sectors. About 300 people are employed in Cayirova.

#### Residual materials recycling

### Employees sort waste

**Izmir.** In 1996, the Izmir plant initiated a project involving the sorting of residual materials by its employees. It was preceded by an extensive information and training campaign for the workforce. After just a few months, it became clear that the program is sustainable and promises long-term success. The residual materials which are collected, including paper and cans, are handed over to external contractors for disposal and recycling.

Another objective is to reduce pollution levels in the site's wastewater. Initial steps scheduled for this year include the preparation of a register, in which the measured values characterizing the wastewater pollution of each individual plant will be recorded. This will serve as the basis for an action plan.

The main aims are to significantly reduce the ►organic load of the site's wastewater and to cut the total volume of wastewater. The environmental benefit will be immediate, since the site's wastewater is discharged into the sea following purification.

#### Wastewater action plan

### Sewage sludge to be reduced by 70 percent

**Cayirova.** In 1996, the Cayirova site completed several preparatory measures to pave the way for improvements in environmental protection and safety, including an analysis of the water consumption of the individual facilities. The results will allow management to develop

and implement action plans during 1997.

The site has set itself ambitious goals. It intends to achieve a 40-percent reduction in wastewater by 1998. Sewage sludge output from the biological treatment stage of its wastewater purification plant is to be cut by approximately 70 percent.

**ZA Henkel South Africa Group.** Alrode is an industrial area near Alberton, some 25 kilometers south of the capital, Johannesburg. Henkel mainly produces water-based adhesives at this site, together with smaller amounts of ►solvent-based adhesive systems and so-called hotmelts (hot-setting adhesives, used mainly in the furniture, cigarette making and packaging industries). In addition, the site manufactures ►organic products from renewable raw materials, such as guar, a ►native ►polysaccharide, used as a flocculant in the extraction of precious metals. Henkel South Africa has approximately 650 employees.

#### Employee motivation

### Joint environmental effort

**Alrode.** One focus at Henkel South Africa in 1996 was employee training. Numerous seminars and group discussions addressed environmental conservation, safety, fire prevention, and health protection issues.

The resulting commitment of the workforce to environmental and safety matters was especially evident on June 5, 1996, designated as World Environment Day. Employees got together in teams to clean up the area surrounding the site, even turning their attention to some forgotten corners inside the plant gates.

In addition, the Alrode site has implemented a number of health protection improvements in its adhesives production line. Newly installed extractor systems eliminate employee exposure to fumes from hot product vapors when opening reactors and mixers.

In early 1997, a project was started to reduce atmospheric dust loads in the guar production plant.



Active involvement on the occasion of the 1996 World Environment Day: Henkel South Africa employees clean the area around the Alrode factory site.



**RI Henkel Indonesia.** Henkel Indonesia's production facility is located in the town of Cimanggis, near the capital city of Jakarta. The site employs a workforce of more than 500 people, who produce ►additives and raw materials for detergents and household cleansers, cosmetics, plastics and ►coatings, and auxiliary agents for the papermaking and textile industries, as well as adhesives and metal treatment products.

### Wastewater purification inspected Tested and approved

**Jakarta.** In September 1996, worldwide reports distributed by an international press agency alleged that wastewater from Henkel Indonesia had been polluting the local Situtipar Lake over a period of 10 years. The lake is the main source of drinking water for the surrounding towns and villages. According to the reports, the lake's ecosystem had already been severely affected. The reports went on to suggest that Henkel, while anxious to maintain its status as an ecologically conscious company in Germany, was obviously tolerating inadequate environmental standards in Indonesia. This agency report was published by the press in several countries, including Germany. Henkel Indonesia had no explanation

for these reports. Since starting production in 1983, the company has been using a multistage wastewater treatment plant, incorporating a biological purification stage. The efficiency of this system (e.g., it reduces ►COD levels by well over 90 percent) conforms fully to the standards enforced in highly industrialized countries. More importantly, Henkel Indonesia's wastewater is not discharged into Lake Situtipar, but into the Kali Baru River, which flows into the Java Sea.

Despite these inconsistencies, Henkel Indonesia responded immediately to the accusations and commissioned TÜV Rheinland Indonesia, independent technical consultants, to investigate the site's wastewater situation. Following extensive sampling and an examination of the entire sewage system, TÜV confirmed that there was no possible link between the sewage system and Lake Situtipar. The experts also found that it was impossible for untreated production effluents to reach the Kali Baru through previously unidentified leaks. In their assessment of the plant's current operation, the consultants concluded that all applicable requirements regarding the quantity and quality of the company's wastewater discharge were being fully met. It was no longer possible to identify the origin of the false press reports.



Henkel Indonesia's wastewater treatment systems are in perfect working order.

**AUS Henkel Australia.** Kilsyth is situated in the Melbourne industrial area in southeastern Australia. At this site, some 60 employees of the Surface Technologies management sector produce specialty chemicals for the treatment of metal surfaces.

### Waste reduction Separate collection

**Kilsyth.** Preventing or reducing waste, or at least recycling unavoidable waste, is a stated objective at the Kilsyth site. In line with this goal, a study was conducted to analyze the waste management situation in all areas, including administration. A waste reduction program has now been launched, involving separate collection of all waste from production and administration areas by type of material, e.g., paper, glass, steel, shrink film, pallets, etc.

Now, 85 percent of the steel drums used in the company's production operations are cleaned and recycled. The progressive trend toward containerized raw material supplies also helps to reduce waste volumes. In the future, further opportunities of cutting back on waste will be identified and exploited.

The workforce is kept continuously up to date on the progress of this waste reduction drive. In addition, the site's management attaches great importance to personnel training. Each employee spends an average of three hours per week, i.e., 8 percent of his or her total working time, in training and education programs.

Lowering the site's water consumption, particularly by using less cooling water, is another objective. Pilot trials on one cooling tower are currently in progress. They have shown that over 800 cubic meters of water per year can be saved, even if the cooling tower does not operate at full capacity.





Production at near-zero emission rates: the alkyl polyglycoside plant in Cincinnati.

USA

### Henkel Corporation.

Henkel's US and Canadian activities are carried out through Henkel Corporation, which employs more than 3,500 people. One of its production plants is in Charlotte, North Carolina. Here, a workforce of about 100 manufactures ►organic specialty chemicals and ►surfactants for the cosmetics, textile, paints and coatings, and papermaking industries. The largest North American production plant is in Cincinnati, Ohio. It has a workforce of about 600 people, and produces oleochemical base substances and specialty chemicals.

The plant in Kankakee, Illinois, turns out a range of highly specialized chemical products, which are used in the manufacture of plastics, pharmaceuticals, cosmetics, paints, adhesives, detergents, and household cleansers etc. It also produces vitamin E based on natural raw materials. More than 400 people work at the plant.

The plants at Lock Haven, Pennsylvania, and Mauldin, South Carolina, produce specialty chemicals, mainly for the textile, papermaking, and plastics industries, as well as dyestuff intermediates. Lock Haven employs about 25 people, and Mauldin around 80.

Toluene emissions

### Low levels

**Charlotte, North Carolina.** This plant has made remarkable progress in reducing its ►organic ►solvent ►emissions. Between 1989 and 1995, ►toluene emissions were reduced from 139 to 38 metric tons, corresponding to a 72-percent decrease. In 1996, this trend was successfully continued, and toluene emissions were cut by another 47 percent, to 18 metric tons. Despite this very low level, production managers aim at a further reduction to 10 metric tons by 1999, although production volumes are scheduled to increase markedly, as in previous years.

A major improvement at the Charlotte plant in 1996 was the installation of a covering on the wastewater treatment plant. This step has clearly reduced unpleasant odors, which had been a source of community complaints.

Final settling tank

### Sophisticated operation

**Cincinnati, Ohio.** Increased utilization of production capacity has led to increased levels of ►organic substances in the plant's wastewater.

The ►biological oxygen demand (BOD) of the wastewater and its suspended solids content were two problems which needed attention. Following a detailed analysis of the wastewater situation, carried out in cooperation with an independent institute, a series of BOD reduction measures was initiated. For example, the practice of using water to wash out organic components from the exhaust air of various production plants, which gave rise to polluted wastewater, has been stopped. The exhaust air is now incinerated in a central facility. The selective treatment of individual wastewater streams in the production plants has further reduced the organic load. In one production plant, an annual 36 metric tons of ►methanol are isolated from the process wastewater and fed back into the process.

The program has brought about a 23-percent reduction in the BOD load of the whole plant. At the same time, a highly sophisticated method of operating the secondary settling tank has yielded a 33-percent drop in the concentration of suspended solids in the plant's wastewater outflow.

The site has even more ambitious plans, however. One of its targets is to achieve another 10-percent decrease in BOD loads by the end of 1997.

Active on a broad front

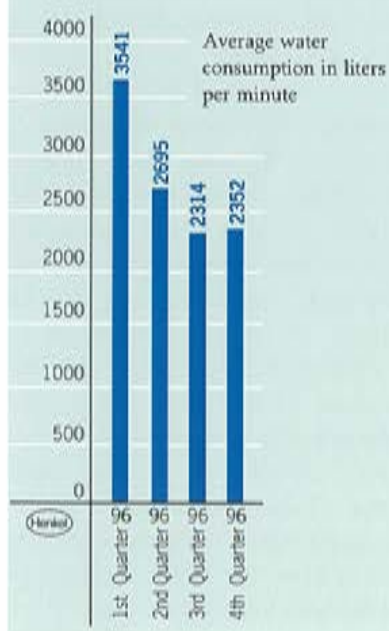
### Joint creativity

**Kankakee, Illinois.** A broad range of environmental and safety measures was implemented at the Kankakee plant in 1996. One central concern was the improvement of the plant's wastewater situation. The problem was an excessively high concentration of suspended solids and ►organic substances. Remedial action included the construction and start-up of a 3,000 cubic meter equalization tank, which allows operators to even out the intense fluctuations in wastewater volumes and to run the sewage treat-



### Water demand in 1996

Henkel Corporation, USA  
Kankakee, Illinois, plant



ment plant at a constant flow rate. This will ensure consistently high treatment efficiency.

In the past, discharge surges could increase the rate of flow by as much as 40 percent. The wastewater treatment plant could not handle these peaks, and it therefore functioned less efficiently.

The reduction in the overall volume of wastewater has also reduced the rate of flow into the treatment plant. The effects of the new method of operation are evident. Whereas the total suspended solids were previously in the region of 1.3 kilograms per cubic meter, they are now down to about 0.3. This represents a decrease of more than 70 percent.

Before the organic loads can be reduced, a project team has to analyze the pollution of each process wastewater stream. This is planned for 1997. The goal is a 65-percent reduction in total suspended solids and a 25-percent cut in organic loads in the plant's wastewater by late 1997. If the project team reaches its goal, this

will not only benefit the environment, but will also result in substantial cost savings for the plant.

An initial reduction in organic loads has already been realized through the installation of oil skimmers in the plant's sewer system, in conjunction with a number of residue recovery measures in the various facilities. The list of Kankakee's achievements does not end there, however. The site's water consumption has been slashed by 33 percent, equal to 1,100 cubic meters per day. A new exhaust air combustion plant is currently undergoing trials, and the use of new filter technology will cut annual waste volumes by 230 metric tons.

The Kankakee site management takes a close interest in the health of its employees, even beyond the workplace. The program ranges from videos and bulletin board notices to health clubs, Weight Watchers' classes, aerobics, posture training, and hepatitis vaccinations. These services benefit both the employees and the company. After all, an employee who is in good physical shape works better, is less likely to cause accidents, and incurs lower sickness costs.

The special efforts made in this field have also caught the public's attention. The HealthCor Occupational Health Services of Kankakee's St. Mary's Hospital has presented an award to the company for its exceptional commitment to the improvement and protection of the health of its workforce.

Synthetic fiber dyes

### The right sequence

**Mauldin, South Carolina / Lock Haven, Pennsylvania.** An impressive demonstration of how economics and ecology can be beneficially combined was provided by a joint project team of the Mauldin and Lock Haven plants. Both plants are involved in the production of chemical intermediates

for important synthetic fiber dyes. The raw materials for these intermediates are processed in three successive chemical reaction steps. Some of the special reactors used for this purpose are located at Mauldin, and some at Lock Haven.

### Reaction steps reversed

With the old production method, the intermediates produced in the first reaction step at Mauldin had to be shipped to Lock Haven, where they underwent a not only costly, but also energy- and labor-intensive, purification process. The project team discovered that no undesirable by-products are created if the sequence of the three reaction steps is reversed, and the purification stage is therefore no longer necessary. This results in considerable labor and cost savings.

Energy consumption at the Lock Haven plant has been reduced by 30 percent. Water consumption there and at Mauldin has been cut by 8 percent, while the amount of waste produced is as much as 80 percent lower. Since the new process also means a 10-percent increase in yield, additional raw material savings are achieved as well. In addition, the reversal of the reaction sequence has eliminated much of the transportation between Mauldin and Lock Haven. The associated reduction in shipping volumes amounts to approximately 60 percent, with an equivalent decrease in transport-related emissions.

Customers confirm that the product of the new reaction sequence is of the same quality as its predecessor. At the same time, the reduction in manufacturing costs has yielded benefits in international competition.





Production in a green environment: The Henkel plant at Jacarei, Brazil.

BR

### Henkel Indústrias Químicas.

The town of Jacarei is situated near the highway connecting São Paulo and Rio de Janeiro, in a rural area near the Paraíba River. The local Henkel plant's workforce of about 400 employees mainly produces ►organic specialty chemicals and adhesives.

Greener environment

### A company plants trees

**Jacarei.** A focus of the Jacarei site's environmental and safety effort in 1996 was its employee motivation program. One result is a waste separation plan, whereby materials such as paper, plastics, fluorescent lamps, etc., are separately collected and routed through the appropriate recycling channels. Last year, the company collected 126 metric tons of paper alone.

The plant management is also determined to improve the wastewater situation. It therefore initiated a comprehensive study to characterize the wastewater streams in the various parts of the plant. The main aim is to reduce the organic load and the concentration of suspended solids in the wastewater. An action plan will

be drawn up in 1997. Attention is also being paid to groundwater protection. The tank farms of the oleochemical production units were equipped with catch pots and collection systems to protect the soil in the case of an accidental spill and to avoid groundwater contamination.

Even on the outside, the company has acquired a new "green" appearance. As part of a nature conservation project conducted jointly with Companhia Energética de São Paulo (CESP), an entire nursery of tree seedlings has been planted on the site. In 1996, an area of the lot adjoining the river bank (approx. 1,000 sq.m.) was covered over with topsoil, and trees and shrubs were planted.

RA

### Henkel Argentina.

The Henkel factory is located in the Avellaneda industrial area of the capital, Buenos Aires. Some 200 employees manufacture specialty products for the cosmetics, textile, plastics and paint industries, in addition to products for the treatment of metal surfaces.

Biological wastewater treatment

### Fewer emissions

**Avellaneda.** Stricter legal requirements prompted the management of Henkel Argentina to build the company's own sewage treatment plant in 1996. Since the substances present in the wastewater are easily biodegradable ►surfactants and various oleochemical compounds, the site management decided, in cooperation with the local public authorities, to install a biological wastewater treatment system.

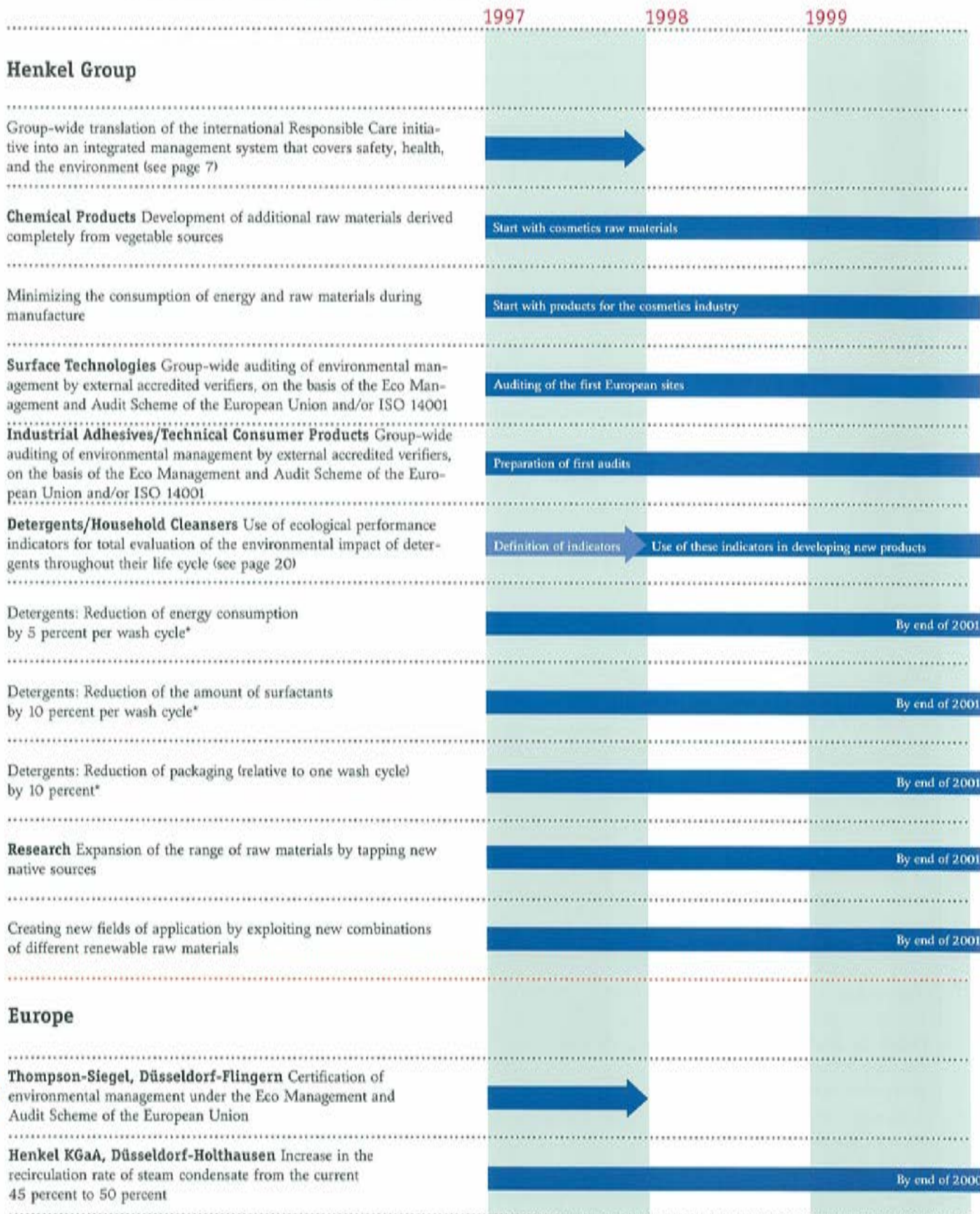
The system consists of a large buffer tank in which the wastewater is collected, an aeration tank in which the pollutants are biodegraded by ►microorganisms, and a final settling tank, in which these microorganisms are separated from the now clean and clear water. The resulting purified water, amounting to some 150 cubic meters per day, is discharged together with cooling water and storm water. The remaining sewage sludge is dewatered and shipped off-site for disposal. The environmental benefit: 90 percent fewer ►emissions of biodegradable ►organic substances are channeled into the receiving water.



The new sewage treatment plant at Avellaneda can handle about 150 cubic meters of wastewater each day.



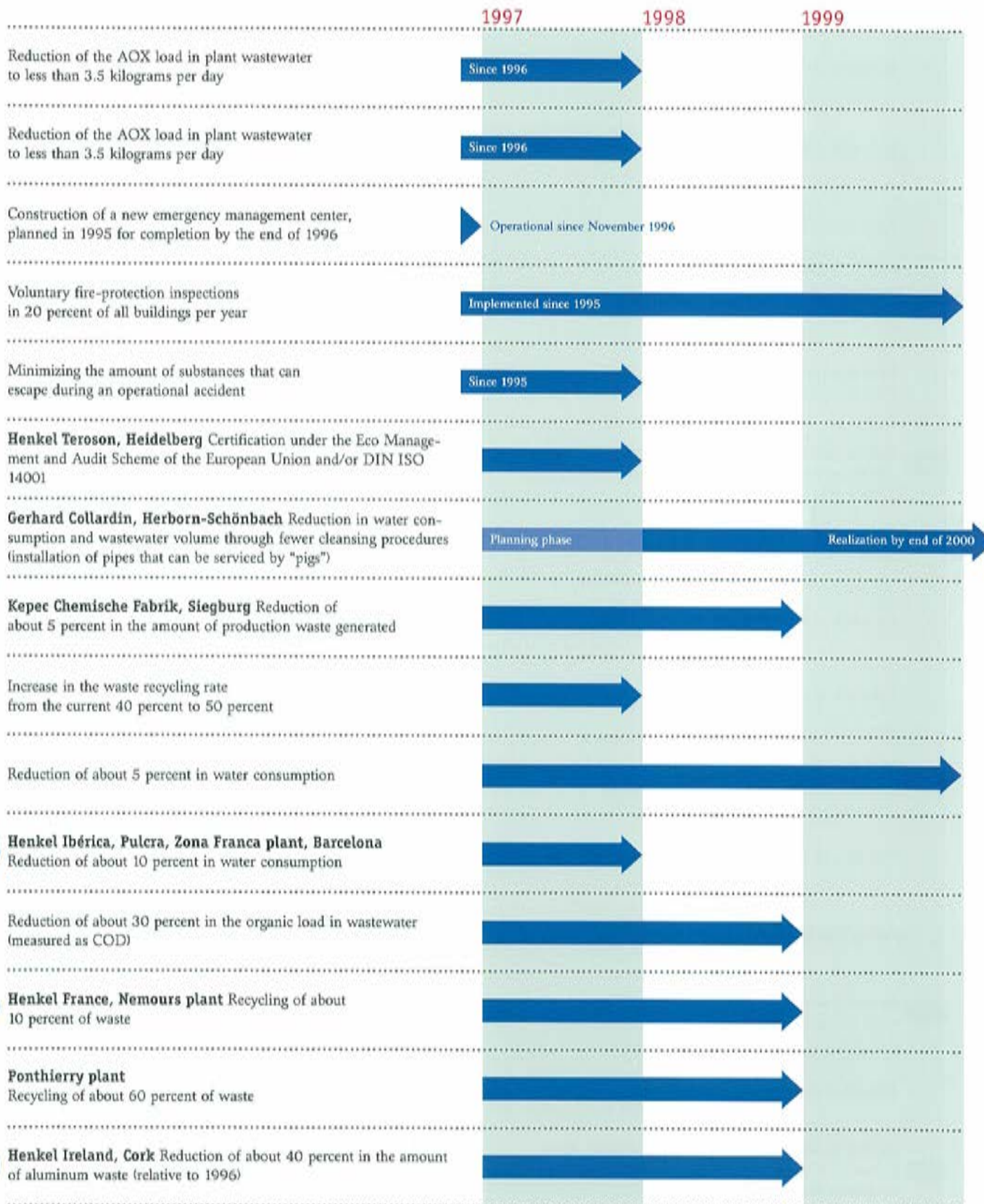
# Environment program



The arrows mark the planned timescale for achieving the stated objectives. The status of projects that were started before 1997 is marked.

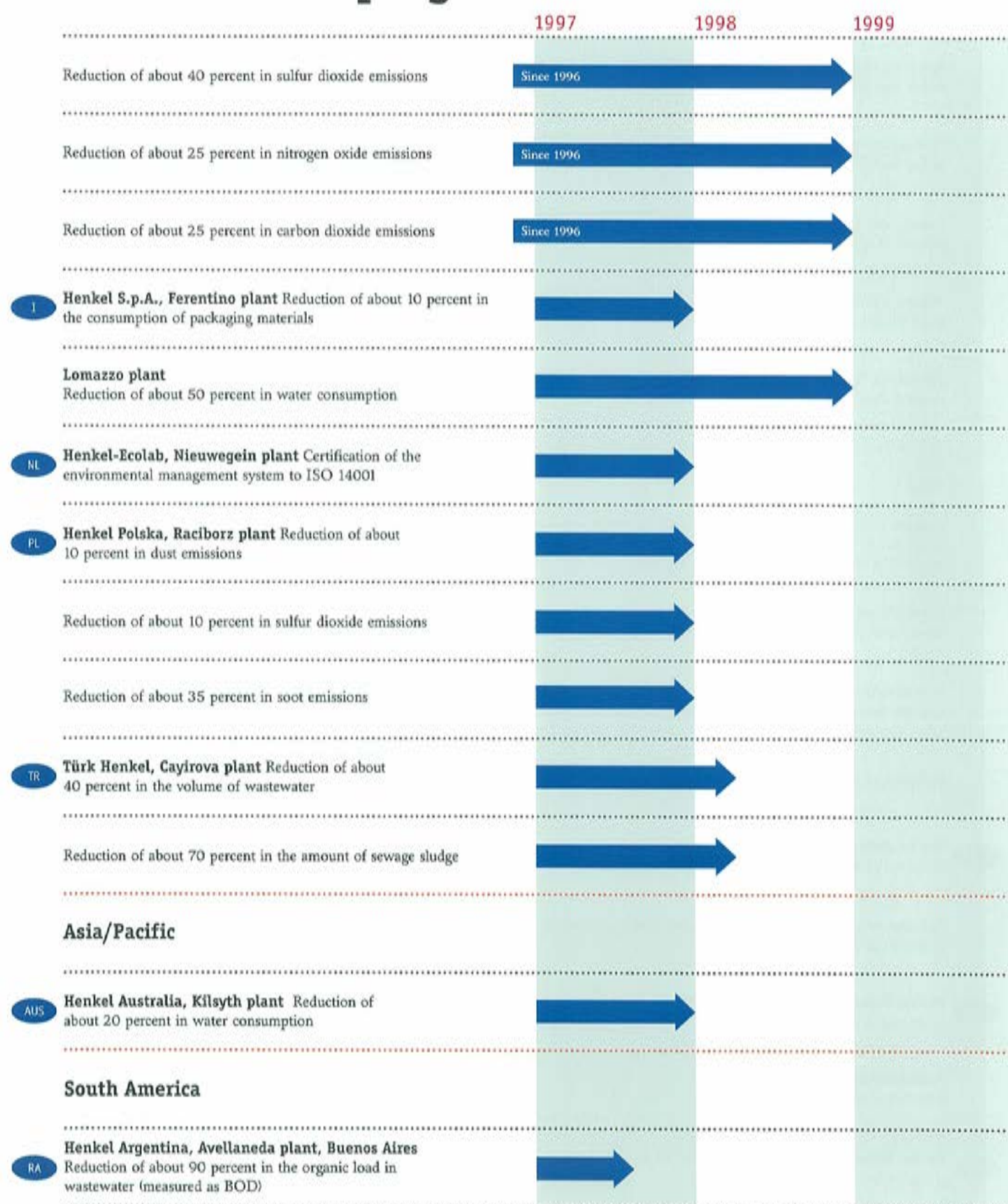
\*Objective conforms to the Code of Good Environmental Practice of the European detergents association A.I.S.E.



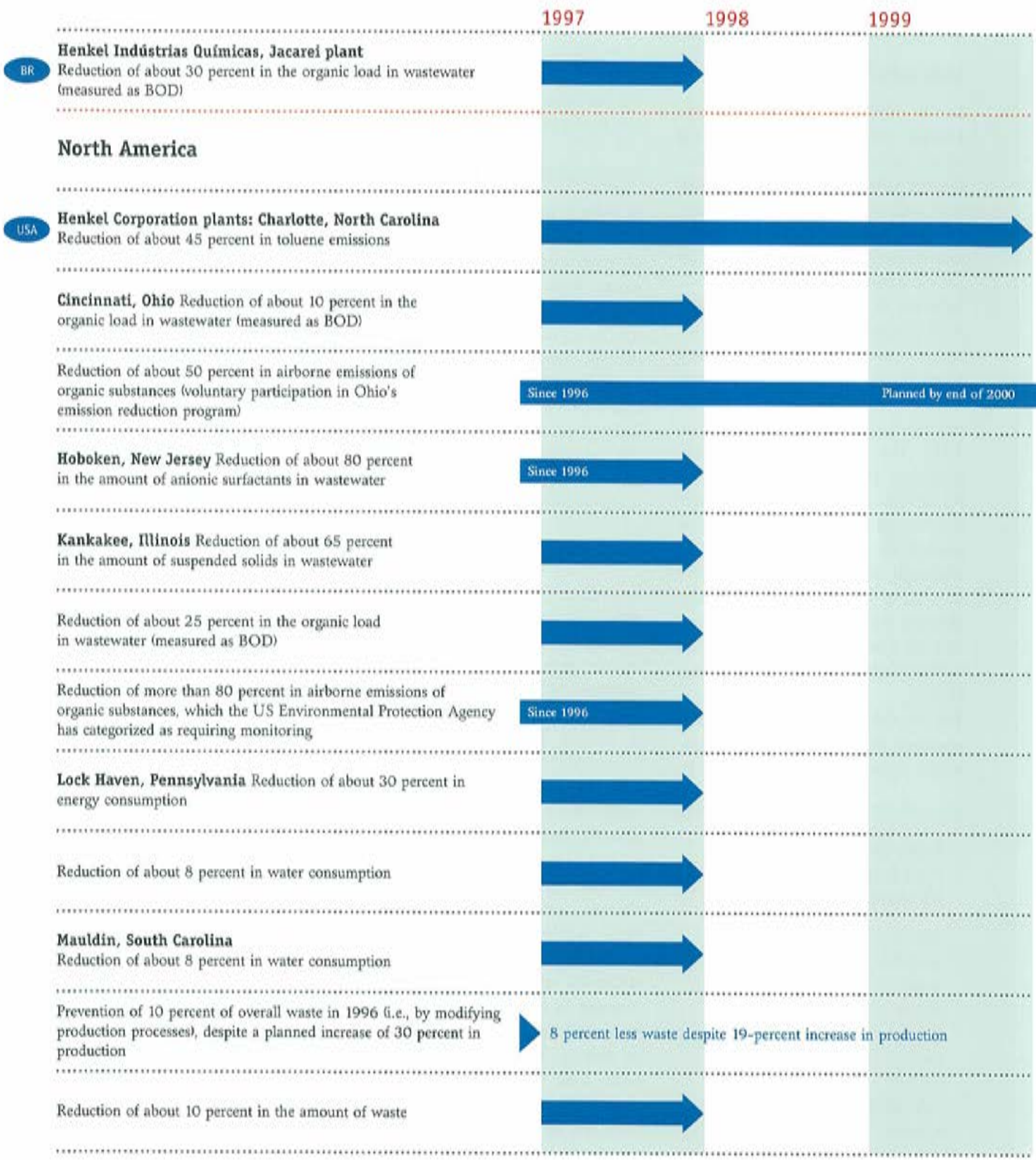




# Environment program









## Explanatory notes on the Henkel Group environmental data

### Data collection expanded

In its 1996 Environment Report, Henkel published data about the whole Group for the first time. During the past year, Henkel's internal data collection system has been expanded as planned, so that data on wastewater and waste can also be provided in this year's report.

Whereas 31 especially important sites were covered in last year's report, the environmental data in the following pages have been accumulated from 52 sites. The newcomers have been incorporated retrospectively back to 1992. The figures for energy consumption and airborne ►emissions for the years 1992 to 1995 are therefore no longer identical with those given in the 1996 report.

Although 65 percent more sites have now been included, the data have changed only slightly. This confirms that the data published in 1996 were representative of the entire Henkel Group.

The record-keeping system for expenditure on environmental and consumer protection and the consump-

tion of ►chlorinated hydrocarbons is not site-related and covers all companies in the Henkel Group.

### Consumption of resources

In order to make energy consumption more transparent, the relevant data have been differentiated according to energy sources. The significance of water as a resource differs from country to country. However, because Henkel wishes to use this resource as sparingly as possible, even in countries with an abundant supply of water, and since water-saving projects are already in progress at many sites, the Group's water consumption is also published in this report.

### Wastewater situation

Regarding wastewater emissions, the significant factor is the magnitude of the loads actually discharged into surface waters. Of the 52 companies covered, 15 are direct dischargers. This means that the site wastewater is treated in-house and is then discharged into surface waters (for example, a river or the sea). The wastewater loads of these sites can be added directly to the amount for the Henkel Group as a whole. The other 37 sites, however, are indirect dischargers, and only a proportion of their wastewater loads therefore enters the environment. In order to reflect the actual burden on the environment in the total amount for the Henkel Group, it was assumed that, on average, 70 percent of the wastewater load from these indirect dischargers is degraded or eliminated in municipal or jointly operated sewage treatment plants.

►Heavy metals are eliminated in sewage treatment plants by ►adsorption on sewage sludge. Depending

on the composition of the sludge, it is either used as an agricultural fertilizer or dried and incinerated. The ashes resulting from the incineration are disposed of in landfills. Traditionally, zinc is also recorded as a heavy metal. However, its environmental impact is of a different dimension from that of lead, nickel and chromium. For example, sewage sludge that contains zinc can be used as an agricultural fertilizer in areas where there is a shortage of this metal. For this reason, zinc is shown separately in the graphs of heavy metal loads.

### Occupational safety

The figures on occupational accidents only cover the Henkel Group's German companies. Reportable occupational accidents are defined differently in the various countries, depending on the prevailing national legislation. In view of the absence of a common basis for recording these data, it does not seem worthwhile to try to arrive at a cumulative figure. Comparisons between sites and regions are not possible. A new, Group-wide, unified system of record-keeping is currently being set up in accordance with internal Henkel criteria.

### Data on individual sites

Selected up-to-date environmental data from individual Henkel Group sites are published in the chapter on production. The environmental data relating to Düsseldorf-Holthausen, which were previously contained in the Environment Report, as well as the data from sites that have participated in the ►EU Eco Management and Audit Scheme are included in the relevant Environmental Statements. These Statements are available on request (see last page).

#### Representative survey Data from 52 sites in 23 countries

Argentina	Mexico
Australia	Netherlands
Austria	Poland
Belgium	Portugal
Brazil	Sweden
France	Slovenia
Germany	South Africa
Great Britain	Spain
Indonesia	Thailand
Ireland	Turkey
Italy	USA
Japan	



### Expenditure on environmental and consumer protection

Henkel Group  
in DM millions

- Investments
- R&D
- Operating costs

The operating costs are mainly attributable to the operation of plant intended to reduce ►emissions ("end-of-pipe" technology). The investments relate to the construction of such plant. In future, as the emphasis shifts towards integrated environmental protection, such investments will become less significant, as will the expenditure recorded here for research and development, which only relates to projects specifically concerned with environmental and consumer protection. Integrated environmental protection takes account of environmental protection and safety aspects as early as the product and process development stages, as well as at the plant construction stage. It is, therefore, not possible to isolate the additional costs involved.

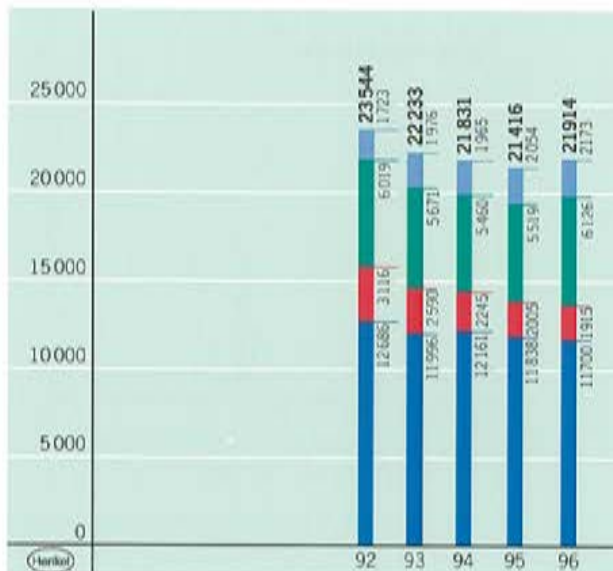


### Energy consumption

Henkel Group  
in ►terajoules

- Source of energy
- Electricity
  - Coal
  - Fuel oil
  - Gas

The electricity is bought-in.

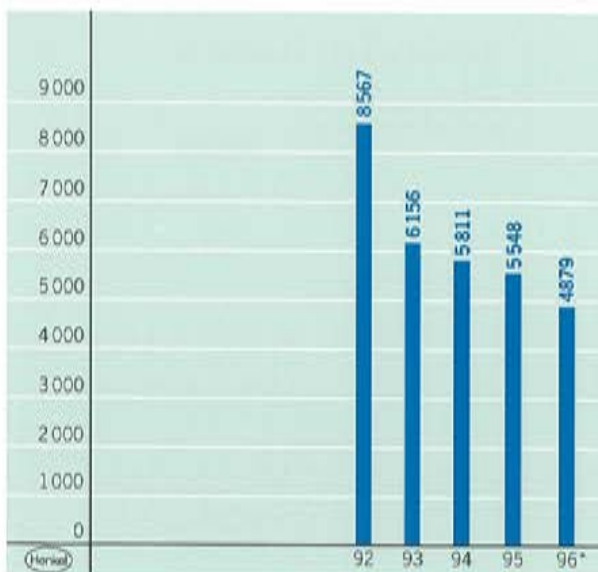


### Sulfur dioxide emissions

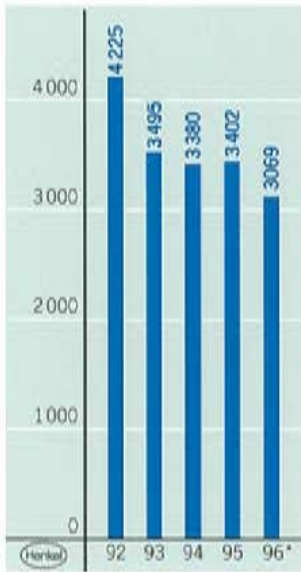
Henkel Group  
in metric tons

The reduction in ►sulfur dioxide ►emissions in 1993 was largely attributable to the coming on line of the new energy production plant at the eastern German site Genthin, and the abandonment of coal as a source of energy at the Turkish site Cayirova.

\*Provisional values; at the time of going to press not all data had been finally evaluated.





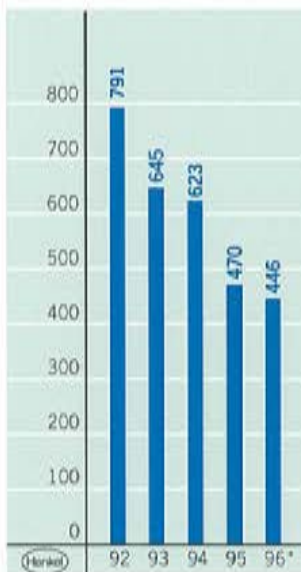


### Nitrogen oxide emissions

Henkel Group  
in metric tons  
(calculated as nitrogen dioxide)

The reduction in ►nitrogen oxide ►emissions in 1993 is largely attributable to the coming on line of the new energy production plant at the eastern German site Genthin.

\*Provisional values; at the time of going to press not all data had been finally evaluated.



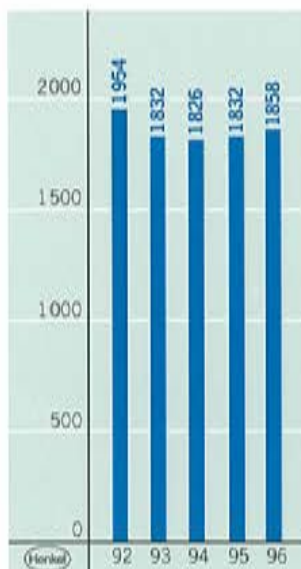
### Dust emissions

Henkel Group  
in metric tons

The values include ►aerosols, as aerosols are difficult to distinguish from dust with the available measuring technology.

The decrease in dust ►emissions is largely attributable to dedusting measures at eastern European sites.

\*Provisional values; at the time of going to press not all data had been finally evaluated.



### Carbon dioxide emissions

Henkel Group  
in thousand metric tons

The data shown in the chart also include ►carbon dioxide formed during the generation of bought-in, i.e., externally generated, electricity. Since this carbon dioxide was not emitted at the Henkel sites, the amount was estimated with the help of a recognized factor which assumes relatively high carbon dioxide ►emissions per unit of generated power.



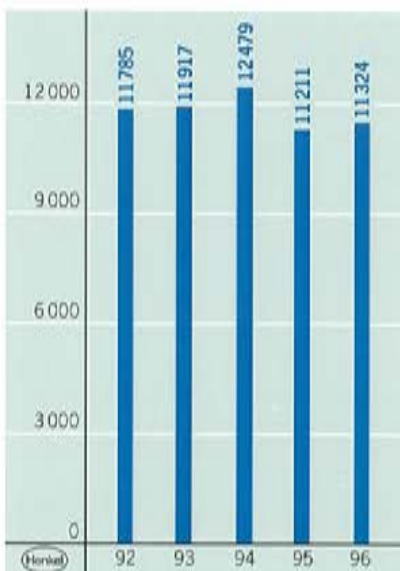


### Water consumption and volume of wastewater

Henkel Group  
In thousand cubic meters

- Water consumption
- Volume of wastewater

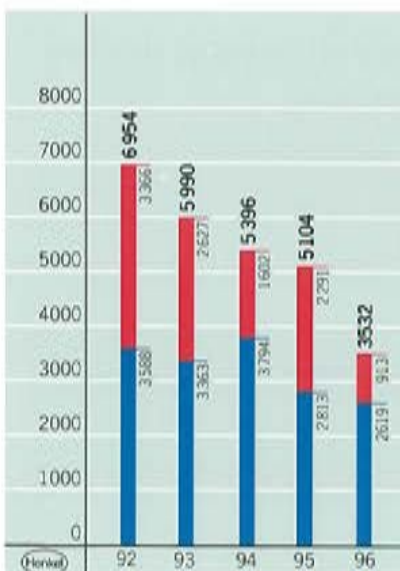
The water consumption includes all water, whether bought-in or extracted from Henkel's own sources. Most of this water is process water. Only a small proportion of drinking water is used. The volume of wastewater is less than the volume of water consumed. The difference is accounted for by evaporation losses from cooling towers and the water that is present in products. Precipitation water (e.g., rainfall) is not included in the wastewater figures.



### COD emissions into surface waters

Henkel Group  
In metric tons

For sites that are indirect dischargers it was assumed that an average of 70 percent of the organic load of the site wastewater - measured as chemical oxygen demand (COD) - is degraded in jointly operated or municipal sewage treatment plants. A number of sites have set themselves the objective of reducing the organic load in their wastewater (see pages 43 to 45).



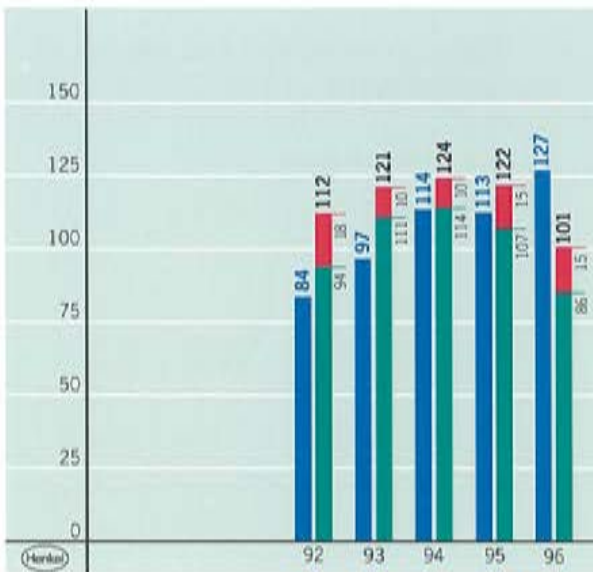
### Emissions of heavy metals into surface waters

Henkel Group  
In kilograms

- Heavy metals\*
- Zinc

For sites that are indirect dischargers it was assumed that an average of 70 percent of the heavy-metal load of the site wastewater is eliminated in jointly operated or municipal sewage treatment plants. Zinc emissions are regarded as less critical than those of the other heavy metals and are therefore shown separately. \*Sum of the loads of lead, chromium, copper and nickel; other heavy metals, especially the ecologically hazardous mercury and cadmium, are not used or processed in the production facilities of the Henkel Group.





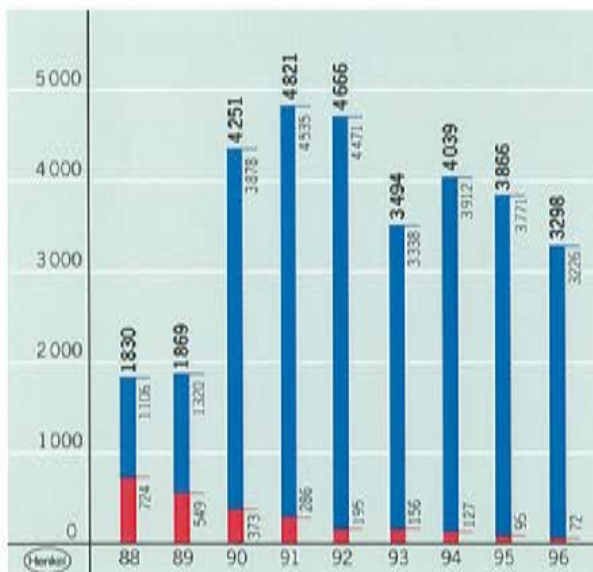
### Waste for recycling and disposal

Henkel Group  
in thousand metric tons

- Waste for recycling
- Waste for disposal\*
- Hazardous waste for disposal

"Hazardous waste for disposal" includes not only those kinds of waste that are classified as hazardous under the laws of the relevant countries, but also all hazardous wastes listed in the ►Basle Convention of 1989. Because individual countries continue to extend their lists of hazardous wastes, it is possible for the volume of hazardous waste to increase without any change having occurred in the waste situation in the Henkel Group.

\*excluding hazardous waste

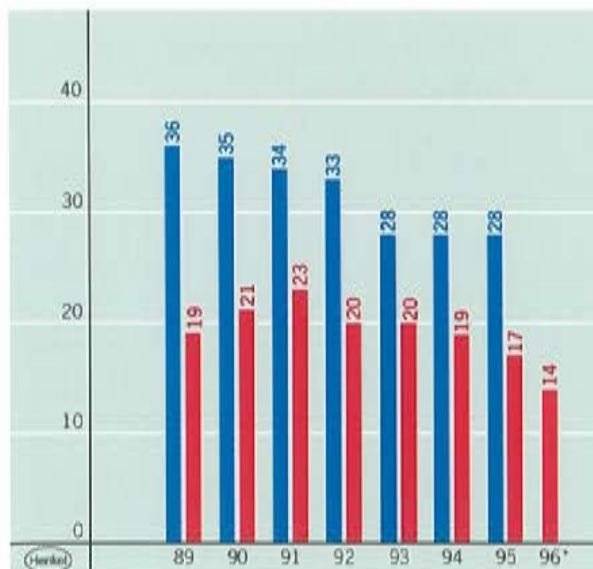


### Consumption of chlorinated hydrocarbons

Henkel Group  
in metric tons

- Germany
- Outside Germany

The increase outside Germany in 1990 was attributable to the acquisition of new companies, such as the largest British manufacturer of pickling agents that still contain ►chlorinated hydrocarbons. On European markets outside Germany, acceptance of alternative products without chlorinated hydrocarbons has not matched expectations.



### Reportable occupational accidents

per thousand employees

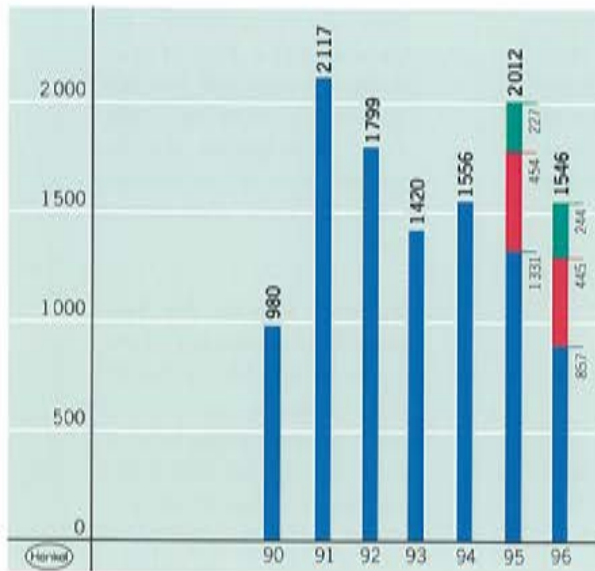
- Workers' Compensation Insurance of the Chemical Industry (BG Chemie) in Germany
- Henkel Group in Germany

In Germany, an occupational accident has to be reported if it causes an employee to be off work for more than 3 working days (excluding the day of the accident).

\*At the time of going to press, no figures for 1996 were available from BG Chemie.

Sources: Henkel and BG Chemie





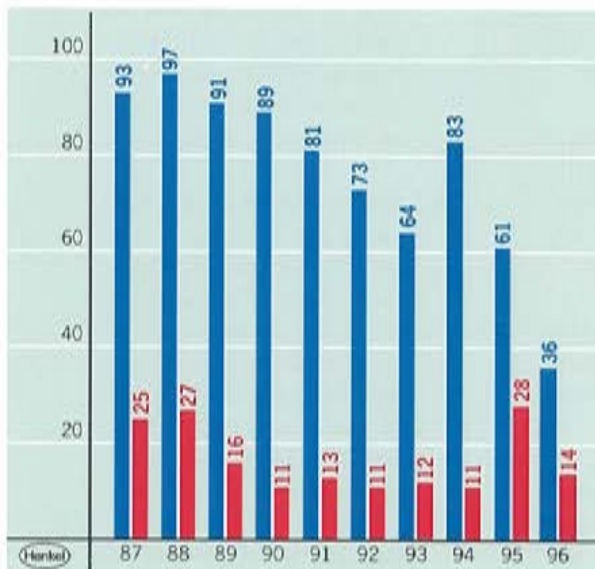
### Environmental protection courses

#### Employees trained

- Henkel parent plant, Düsseldorf
- Henkel Group companies in Germany
- Contractors working at the Henkel parent plant

Since mid 1990, employees have undergone target-group-specific training in a systematic program of seminars and have been made more aware of the importance of environmental and safety issues.

In 1995, these training courses were extended to employees of contractors carrying out work at the Henkel parent plant, and to other Henkel Group companies. In addition, discussions on environmental protection and safety are also held at least twice yearly in the various departments. Moreover, environmental protection seminars, which are open to all, are held in the context of advanced training. Special advanced training courses are organized for management personnel as well.



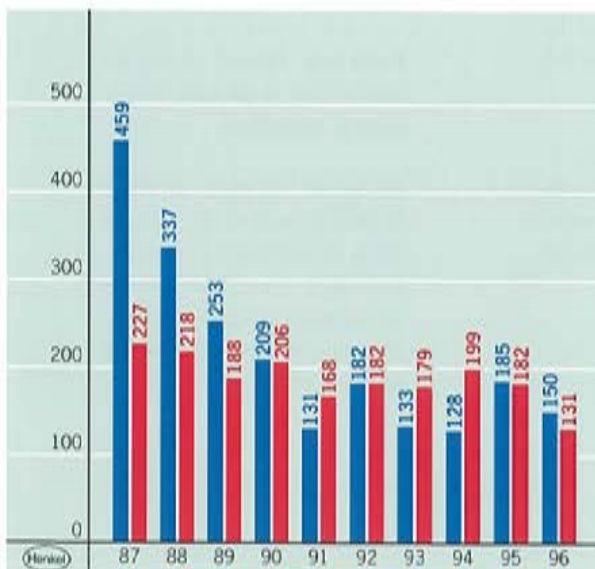
### Environmental monitoring Surfactants in the Rhine

Measuring site: Düsseldorf-Himmelgeist  
in grams per second (►yearly median values)

- Anionic surfactants (►MBAS)
- Nonionic surfactants (►BIAS)

Since 1958, Henkel has carried out systematic analyses of the concentration of ►anionic ►surfactants in the Rhine and selected tributaries. After ►nonionic surfactants started to be used on a large scale in detergents and cleansing agents, in 1972 the analyses were also extended to include this product group. The increased value in 1995 was caused by temporary peak concentrations of BIAS of unknown origin, possibly attributable to the presence of unspecific nonsurfactant bismuth active substances.

The measurements in the Rhine are carried out every two weeks. The results are expressed as the statistically more significant median values. The loads therefore differ slightly from the average values published in earlier environment reports.



### Environmental monitoring Boron and phosphate in the Rhine

Measuring site: Düsseldorf-Himmelgeist  
in grams per second (►yearly median values)

- Orthophosphate calculated as phosphorus
- Boron

Although Henkel had switched to phosphate-free formulations for all its detergents in Germany by 1989, it still monitors the phosphate content of surface waters.

Boron is present in many detergents in the form of the bleaching agent sodium perborate.

The measurements in the Rhine are carried out every two weeks. The results are expressed as the statistically more significant median values. The loads therefore differ slightly from the average values published in earlier environment reports.



**A Additives** Substances that are added for the purpose of imparting specific properties to a product.

**Adsorption** Attachment of gaseous or dissolved substances to a carrier material with a large surface area. Adsorption can be used to remove substances from gases or liquids.

**Aerobic** Environment characterized by the presence of free oxygen.

**Aerosols** Finely distributed solid or liquid particles suspended in air or other gases, e.g., smoke or fog.

**Alcohols** ▶Organic compounds whose molecules contain one or more OH-groups. This makes them more soluble in water than the hydrocarbons from which they are derived.

**Alkalinity** Term for the strength of alkali lyes. ▶pH (which is greater than 7 in the case of lyes) is a measure of alkalinity.

**Alkylbenzene sulfonate**  
▶Surfactant derived from ▶petrochemical raw materials.

**Alkyl polyglycosides (APG)**  
▶Surfactants made only from ▶native raw materials such as starch and sugar on the one hand and ▶fatty alcohols on the other.

**Amines** Class of ▶organic compounds that contain nitrogen.

**Amine-containing** Mixture that contains an ▶amine.

**Anaerobic** Environment characterized by the absence of free oxygen.

**Anionic surfactants** ▶Surfactants that break down into electrically charged ▶ions in aqueous solutions, and whose special surfactant properties are attributable to the negatively charged ▶anions.

**Anions** Negatively charged ▶ions.

**Antiseptic** Substance that destroys germs.

**Aromatics** Class of ▶organic compounds derived from ▶benzene.

**B Basle Convention** International treaty, concluded in 1989, which regulates the cross-border transport of hazardous waste.

**Benzene** The ring, consisting of six carbon atoms, is characteristic. Benzene is the simplest representative of the class of substances known as ▶aromatics.

**BIAS (Bismuth Active Substance)** An analytical parameter for expressing the total content of ▶nonionic ▶surfactants.

**Biological oxygen demand (BOD)** Parameter expressing the pollution of wastewater with biodegradable ▶organic substances. The BOD value is the amount of oxygen needed by ▶microorganisms to degrade the ▶organic substances.

**Biomass** Mass of ▶microorganisms formed during the degradation of ▶organic materials in biological sewage treatment plants.

**BSE** (bovine spongiform encephalopathy) A form of brain disease in cattle that was first identified in November 1986. There are indications that the causative agent may be transmitted to humans in some isolated cases.

**Business Charter for Sustainable Development** Charter agreed at WICEM II (Second World Industry Conference of Environmental Management) in Rotterdam in April 1991. It formulates principles of environmental management. WICEM II was organized by the International Chamber of Commerce (ICC) in cooperation with the United Nations Environment Program (UNEP) and the UN Conference on the Environment and Development (UNCED).

**C Carbon dioxide** Gaseous combustion product of all substances that contain carbon. Carbon dioxide contributes considerably to the greenhouse effect. One source of carbon dioxide is the exploitation of fossil raw materials such as coal and petroleum (mainly for energy production or vehicle traffic).

**Catalyst** Special substance that accelerates a chemical reaction while itself remaining unchanged.

**Cellulose** Natural ▶polysaccharide. One of the main components of plant fibers.

**Chemical oxygen demand (COD)** Measure of the total pollution of wastewater by ▶organic substances. The COD value is the amount of oxygen needed to effect the chemical degradation of these substances.



**Chlorhexidine gluconate** Derivative of chlorhexidine, an ►organic compound that contains nitrogen and chlorine and is used as an ►antiseptic.

**Chlorinated hydrocarbons**

►Organic ►solvents with incorporated chlorine, as a result of which they are not flammable. This means that they are safe to handle, but this advantage is offset by disadvantages in the field of environmental protection.

**Chromium salts** Compounds of the ►heavy metal chromium. Some of these salts are acutely toxic and are classified as carcinogenic.

**Contamination** Slight pollution.

**D Deodorization** Process for eliminating odorous substances.

**Derivatization basis** Raw materials used as the basis for the chemical synthesis of secondary products.

**Dermatology** Science of the effects of substances on skin.

**Dispersion** Finely distributed undissolved particles in water.

**Dyeing liquor** Term used in textile processing for the aqueous dye solution or ►dispersion in which textiles are dyed.

**E Ecology** Science of the influence of substances on the environment, especially on water and soil. Henkel carries out numerous ecological studies in order to ensure that its products exert no harmful effects on the environment.

**Ecotoxicity** Toxicity of a substance to various organisms in the biosphere.

**Emissions** Gaseous, liquid or solid substances that enter the atmosphere from industrial production plants, motor vehicles with internal combustion engines, domestic heating systems or during the course of other industrial processes.

**Emulsion** Dispersion of fine drops of a liquid in another liquid, for example, water in oil or oil in water.

**Epoxide adhesives** ►Organic long-chain compounds that are used to bond certain substances, for example metals.

**Ethanol** Monohydric ►alcohol, miscible with water. Formed by alcoholic fermentation. Present in, for example, wine and beer.

**Ethylene oxide** Reaction product obtained from ethylene and used in the manufacture of ►nonionic ►surfactants.

**EU Eco Management and Audit Scheme** Regulation adopted by the European Union (EU), providing for voluntary eco auditing and certification of companies.

**F Fatty acids** Class of substances that are found - bonded to glycerol - in all vegetable and animal fats and oils. Important starting materials for numerous oleochemical derivatives.

**Fatty acid esters** ►Reaction products of ►fatty acids and ►alcohols. The best known fatty acid esters are the natural oils and fats. Other fatty acid esters are intermediate and end products in the widely branching field of oleochemistry.

**Fatty alcohols** Long-chain ►alcohols, which Henkel obtains from fatty acid methyl esters by reacting them with hydrogen (►hydrogenation). Fatty acids are important raw materials for the manufacture of ►surfactants.

**Fatty alcohol sulfates (FAS)** Important group of ►surfactants based on ►fatty alcohols.

**Flow rate** In the context of a settling tank, the volume of wastewater that flows through it in a given time.

**Flue gas desulfurization** Process for removing ►sulfur dioxide from the flue gases emitted by power plants and other firing plants.

**G Gigajoule** Unit of energy. 1 gigajoule is equivalent to 1 billion joules (= 238,800 kilocalories).

**Glucose** Also known as dextrose. Present in almost all sweet fruits.

**Good Manufacturing Practice** World Health Organization (WHO) recommendation first formulated in 1968. External auditors check compliance.

**H Heavy metals** Metals with a density greater than 4.5 metric tons per cubic meter. Because many heavy metals and their compounds are toxic and environmentally hazardous, they are the subject of critical attention. There are, for example, strict limits on the amounts of heavy metals in drinking water and food, arable soil, and wastewater discharged into sewage treatment plants or surface waters.

**Hepatitis** Inflammation of the liver, caused by viruses.



**Hydrogenation** Chemical reaction with hydrogen.

**Hydrogen peroxide** Liquid that is used as an oxidizing agent, a bleaching agent and a disinfectant. On being used, it decomposes into water and oxygen.

**Hydroxylammonium sulfate (HAS)** Nitrogen-containing, salt-like compound.

**I Immissions** Effects of atmospheric pollution, noise, vibration or radiation on humans, animals, plants or objects. In the context of German clean air legislation it refers to the ►emissions absorbed by the atmosphere and distributed up to a certain concentration.

**Indirect dischargers** Companies that do not discharge their wastewater directly into surface waters but into a municipal or jointly operated sewage treatment plant.

**Inorganic compounds** Substances that, in contrast to ►organic compounds, are not based on the key elements carbon and hydrogen. Inorganic compounds include, for example, minerals, acids and salts.

**Ions** Electrically charged particles.

**ISO 14000** International group of standards relating to environmental protection. ISO 14001 is a standard for corporate environmental management systems.

**L Life cycle assessment** A balance sheet of the environmental impact of a product during its total lifecycle - from manufacture or extraction to distribution and use and then disposal, taking account of the raw materials and energy consumed during its manufacture.

**M MBAS (Methylene Blue Active Substance)** An analytical parameter for expressing the total content of ►anionic surfactants.

**Membrane** Thin sheet or film, usually made of plastics or natural products, whose pore structure and material properties are such that it permits certain substances to pass through and remains impermeable to others.

**Methanol** Simplest compound in the group of substances known as ►alcohols. Toxic, flammable, readily biodegradable liquid, which is miscible with water.

**Microbiology** Science of microscopic living creatures. Henkel carries out microbiological tests during the development and safety-validation of consumer products, processes and services.

**Microorganisms** Microscopically small living creatures, for example, bacteria.

**Monitoring programs** Programs for carrying out regular measurements of the concentration of chemicals in the environment, for example, in rivers.

**N Native** Natural, e.g., native substances = substances which occur in nature.

**Nitrite-containing/Nitrite** Salts of nitric acid; sodium nitrite, for example, is used as an accelerator in phosphating processes.

**Nitrogen oxides** Compounds of nitrogen and oxygen, formed, for example, from atmospheric nitrogen during all combustion processes. In order to keep the atmosphere clean, the permissible concentration of nitrogen oxides in exhaust gas is limited.

**Nitrous gases (NO<sub>x</sub>)** Gaseous mixture of ►nitrogen oxides of various degrees of oxidation. They are formed by the breakdown of certain chemicals in small amounts, but also during combustion processes in motor vehicles and power stations.

**Nonionic surfactants** Group of ►surfactants that do not form ►ions in aqueous solutions and are surface-active in both acid and alkaline environments.


**O Organic substances** Substances whose characteristic main element is carbon. Organic substances occur naturally, but can also be manufactured synthetically, for example, from petroleum.

**P Passivation** Physicochemical change brought about on metal surfaces to improve their resistance to corrosion.

**Petrochemical** Obtained from petroleum or natural gas.

**pH** A measure of the basic (alkaline), acidic or neutral character of aqueous solutions. pH 7 is neutral; alkaline solutions have a pH greater than 7; acidic solutions have a pH lower than 7.



- Phosphates** Salts of phosphoric acid. They are essential plant nutrients, but their presence in too high concentrations in bodies of water can cause overfertilization. The phosphates that were previously present in detergents have been replaced by ▶zeolites.
- Plastisol** Adhesive and sealant for metal compounds in auto-body construction. Used for underbody sealing and seam sealing.
- Polyethylene** Plastic manufactured solely from ethylene. Used for consumer articles and packaging materials.
- Polymers** Substances that are composed of a large number of repeated basic units, for example, plastics.
- Polysaccharides** Polymeric (▶polymers), high-molecular sugars such as cellulose or starch, made up of a large number of sugar molecules, for example, glucose or fructose.
- Precipitated silica** Especially finely grained silica, which is formed by precipitation.
- Primary energy** Energy needed to manufacture a product.
- R Responsible Care** A worldwide initiative developed by the chemical industry. It stands for commitment to continuous improvement in safety and the protection of health and the environment, independently of legal requirements. The program is identified worldwide by the same logo. Responsible Care is a registered trademark. 
- S Sizing agent** Auxiliary substance used in the textile industry to enable yarn to be machined and processed more efficiently.
- Solvent-free** Often used to describe products that contain no ▶organic ▶solvents. Although water is also a solvent, it is ignored in this context.
- Solvents** Substances in which high concentrations of other substances can be dissolved. Often understood to refer only to ▶organic ▶solvents, although water is frequently used as a solvent.
- Sulfur dioxide** Gaseous combustion product of sulfur and its compounds. Because sulfur is present in coal and fuel oil, sulfur dioxide is present in the flue gases of these products. In order to keep the atmosphere clean, this sulfur dioxide must be removed in ▶flue gas desulfurization plants.
- Sulfation plants** Production facilities where ▶anionic ▶surfactants that contain sulfate groups (for example ▶fatty alcohol sulfates) are manufactured.
- Sulfonic acids** Sulfur-containing ▶organic intermediate products used to manufacture certain ▶surfactants.
- Surfactants** Surface-active substances that reduce the surface tension of water.
- T Terajoule** Unit of energy. 1 terajoule is equivalent to 1 trillion joules (= 238.8 million kilocalories).
- Toluene** ▶Aromatic ▶organic compound derived from ▶benzene.
- Toxicology** Science of poisons. Henkel carries out toxicological studies to ensure that its products have no harmful effects on humans or animals.
- W Water-based** Products in which mainly water is used to obtain a solution or a ▶dispersion of the active components. Water-based adhesives also contain a small percentage of ▶organic ▶solvents.
- Water glass** Alkaline silicic compound that is soluble in water. Important intermediate product in ▶inorganic chemistry, but also a corrosion-inhibiting component of detergents.
- Yearly median value** Yearly value, calculated from a number of individual measurements by a statistical method.
- Z Zeolite** Sodium aluminum silicates (Henkel brand name Sasil®), whose three-dimensional structure contains cavities, enabling them to combine with ▶ions of hardness elements in water.
- Zirconium fluoride** Metal salt of hydrofluoric acid.



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