Sustainability Report:
Baby diapers and incontinence products

Prepared by:
The Absorbent Hygiene Products
Manufacturers Committee of EDANA

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Foreword

We are delighted to present EDANA's first ever 'Sustainability Report: Baby diapers and incontinence products', an initiative of our Absorbent Hygiene Products Manufacturers Committee's (HAPCO) Environmental Task Force.

This report is a timely document, in line with both today's global drive for increased sustainable development and our industry association's mission 'to create the foundation for sustainable growth of the nonwovens and associated industries through active promotion, education and dialogue'.

Composed of about 200 member companies, EDANA represents, amongst other sub-sectors, the entire supply chain of nonwovens and absorbent hygiene products. Nonwovens are unique engineered fabrics offering cost effective solutions for an ever-increasingly wide variety of applications, such as absorbent hygiene products, surgical gowns and drapes, protective suits and masks, air, liquid and gas filtration, oil spillage products and geotextiles, to name but a few.

We believe this Sustainability Report clearly demonstrates the important role modern disposable baby diapers and incontinence products play in terms of the three key pillars of sustainable development, namely social progress, responsibility for the environment and maintenance of high and stable levels of economic growth and employment.

There can be no question about the numerous benefits that baby diapers and incontinence products bring to today's society, in terms of improved quality of life, cleanliness, healthier skin, cost-effective convenience and, of utmost importance to incontinence sufferers, the additional essential benefits of independence and dignity.

Member companies grouped within EDANA have, for many years, been at the forefront of industry environmental management, for example, with the publication of Environmental Guidelines in the early 1990s, even before the introduction of the Eco-Management and Audit Scheme (EMAS). We have also established a tradition of voluntary industry cooperation and codes of practice in various areas such as product safety. In recent years we have demonstrated ongoing environmental awareness, with the investment of time and resources in several life cycle analyses (LCA) on baby diapers and incontinence products.

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As a result of this early environmental awareness, and as a consequence of the many innovations introduced within this industry throughout the supply chain, the environmental impact of diapers and incontinence products has been measurably reduced over the past two decades, as illustrated by this report.

Our dynamic and fast-growing industry contributes considerably to the European economy and competitiveness. We are committed to improving the life of millions of people by providing superior and innovative products while continuously striving for improvements in the sustainability profile of our products.

We are proud of these achievements in sustainability to date as well as being ever mindful of our ongoing responsibilities. Our industry supports responsible environmental stewardship in its manufacturing processes and acknowledges that our products do contribute to a small fraction of the overall household waste stream. Manufacturers strive constantly to improve the overall environmental profile of their products, and waste reduction is a key focus area. Over the past 15 years the industry has achieved around a 40% reduction in the overall weight of baby diapers. Producers have ensured that the products are compatible with prevailing forms of household waste management. This commitment and the evidence in this report should be a source of reassurance for consumers and stakeholders.

EDANA and its member companies endeavour to continue this positive trend and welcome the opportunity for open dialogue with responsible authorities at all levels, as well as with consumer and environmental organisations, to be part of the solution to today's sustainable development challenges.

The industry, as represented by EDANA is committed to striving for continual improvement in all aspects of social progress, environmental performance and economic growth. We embrace the challenge of achieving sustainable development and to do so encourage ongoing innovation and new ways of thinking within our industry.

Knud Waede Hansen
Chairman of the Board of EDANA

Pierre Wiertz
General Manager, EDANA

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Preface

I am very pleased to be able to introduce readers to this document and to be among the first to commend the absorbent hygiene products industry for taking the initiative to produce this report on the sustainability performance of disposable baby diapers and incontinence products.

As defined by the WBCSD[1]: Eco-efficiency is achieved by the delivery of competitively-priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the full product life cycle. In short, it is concerned with creating more value with less impact.

In order to manage this process of continuous improvement, it is of course necessary to objectively measure what the impacts are, not just from product manufacturing operations, but upstream in raw material use and downstream in the product use and post-use disposal phases.

Reporting on these data and trends in an accessible and transparent way is an essential step in the process, as stakeholder acceptance is fundamental to industry maintaining its 'licence to operate' and in ensuring a stable environment for continued long-term investment for innovation.

In taking this initiative to invest their time and resources in compiling this first sustainability report, the absorbent hygiene products industry sector joins the ranks of those leaders who have recognised and embraced the challenge of integrating the quest for economic growth with parallel efforts to achieve continuous improvements in environmentally sound practices.

I recommend this report to all those with a serious interest in understanding this industry and its commitment to progress.

Bill Duncan,
Managing Director ASSURRE[2]

1 World Business Council for Sustainable Development.
2 ASSURRE, the Association for the Sustainable Use and Recovery of Resources in Europe, is a multi-sector industry-led coalition working exclusively on evolving European environmental policy and legislation relating to sustainable resource management. It is recognised by European Institutions and business stakeholders as an authoritative and independent source of knowledge and expertise in the field of sustainable development.

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Executive summary

Introduction

In just about every walk of life today the question of sustainability is on the minds of policy makers, scientists, industrialists, local community groups, customers and environmentalists alike.

Issues related to sustainability affect everything that we do – where we live and how we live, where we work and what we do, what we consume, what our open spaces look like, how we travel, how we view the communities within which we live and how we think about the future. No generation before us has focused so sharply on these issues as we do today.

In this report[1] the manufacturers of disposable baby diapers and incontinence products, who are members of EDANA, document the role their products and processes play in the three key areas generally accepted as critical to sustainable development:

- Social progress which recognises the needs of everyone;
- Effective protection of the environment and prudent use of natural resources;
- Maintenance of high and stable levels of economic growth and employment.

Modern disposable baby diapers and incontinence products

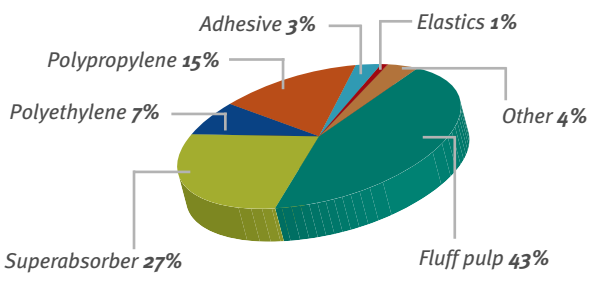
The move towards disposable baby diapers began in earnest in the early 1960s. Before that, diapers were either cotton towelling or cotton muslin which, with laundering, could be reused. The early disposable diaper comprised wadding made from cellulose as the absorbent core with a plastic backing and a synthetic fabric sheeting material as the surface closest to the baby's skin.

Since then, continuous product innovations including the use of superabsorbent polymers, resealable tapes and elasticised waist bands have improved the products considerably. They are now much thinner and much more absorbent as well as being more comfortable to wear and easier to use. Their widespread use has been accompanied by a marked reduction in skin irritation in individual children and a decrease in the spread of infectious diseases amongst children in group care environments. The product range has more recently been extended into children's toilet-training phase with the introduction of training pants and pant diapers.

Absorbent products specifically designed for adult incontinence were introduced into the European market in the late 1960s. While they are based on the same

Graph 1

Average baby diaper composition 2004



1 All data referred to throughout this document has been sourced from the references listed in Appendix 2 or from information supplied by member companies.

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technology as baby diapers, their development demanded new and different expertise because of the size of the product and the diversity of needs to be met by their use.
A wide range of products is now available including gender-specific products, different sizes to suit varying body shapes and anatomies and different levels of absorbency.

Product composition

Modern baby diapers and incontinence products have a layered construction, which allows the transfer and distribution of urine to an absorbent core structure where it is locked in.

- The topsheet closest to the skin is made of soft nonwoven fabric and transfers urine quickly to the layers underneath.
- The distribution layer receives the urine flow and transfers it on to the absorbent core.
- The absorbent core structure is the key component and is made out of a mixture of cellulose pulp and superabsorbent polymers.
- The backsheet is typically made of 'breathable' polyethylene film or a nonwoven and film composite which prevents wetness transfer to the bed or clothes.

Social developments and lifestyle

Modern disposable baby diapers and incontinence products have made an important contribution to the quality of life of millions of people.

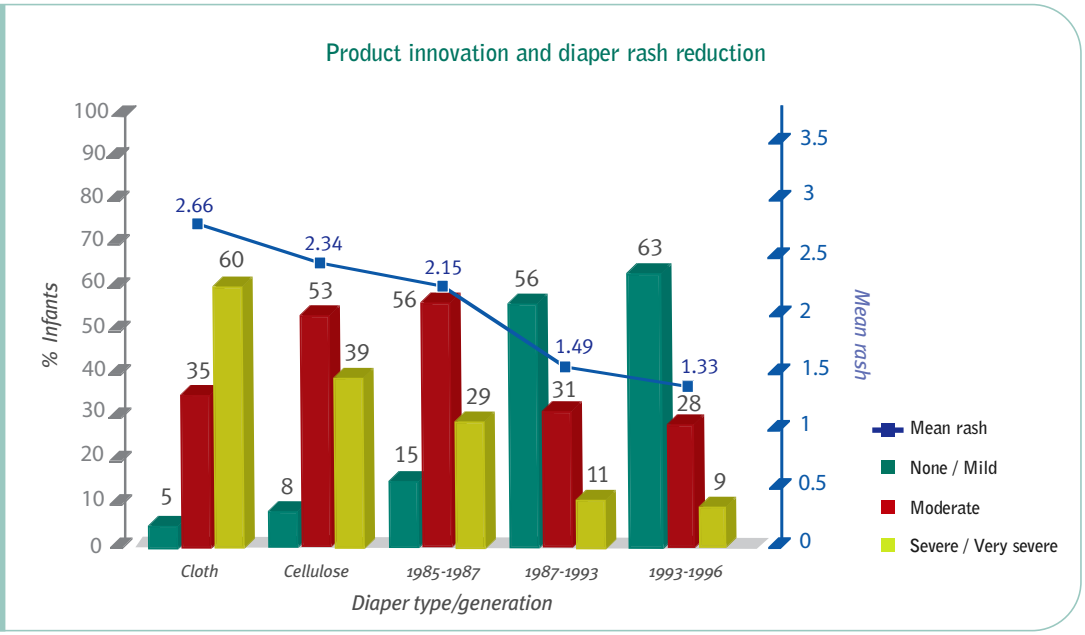
Disposable baby diapers have become the product of choice for over 95 per cent of all families in Europe and are recognised as:

- Being healthy for the infant's skin, reducing rashes and irritations and preventing infections;
- Providing superior comfort for the baby due to their fit, softness, high absorbency and breathable nature;
- Being easy and convenient to use, readily available and cost-effective;
- Eliminating the need for constant laundering, and disposable as part of regular household waste.

Incontinence, which is the inability to control the release of urine or faeces from the body, is experienced by many otherwise healthy and active individuals and can be both distressing and socially isolating. Adult incontinence products contribute significantly to the quality of life of people suffering this condition by:

- Providing hygiene, cleanliness and independence;
- Saving sufferers or their carers the unpleasant task of managing heavily soiled articles;
- Allowing users to maintain their sense of dignity and enabling them to get out, work, take part in social activities and lead a full and satisfying life.

Graph 2



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Skin health benefits

Scientific evidence shows that the advances made in diaper technology over the past 15 years have produced real benefits in skin care, dryness and leakage protection.

Many paediatricians and nurses confirm that the number of infants seen with diaper dermatitis is declining over time. The number of cases of diaper rash reported in general appears to have decreased by about 50 per cent since the introduction of disposable diapers. Noticeably, there has been a large decrease in the number of severe diaper rash cases reported, falling from 67 per cent of all cases seen before the use of disposable diapers to 9 per cent in the 1990s.

Commitment to safety

The principle that our products must be safe for consumers, employees and the environment guides our industry in raw material selection, product design, manufacturing, consumer communications and considerations relevant to the disposal of our products.

We not only comply with the legal framework, but also conduct our own safety evaluation programmes to ensure that our products are safe. Baby diapers and incontinence products have an excellent safety record. They and the materials used within them have been proven to be safe for their intended use and have a long history of safe use by millions of people.

Corporate social responsibility

The manufacturers of disposable baby diapers and incontinence products strive to ensure that we respect and exceed laws and regulations wherever we do business; we operate with due care to health and safety considerations; we encourage diversity; we deal fairly and we actively manage environmental stewardship.

We do not conduct our business in a vacuum but collaborate closely with the communities in which we operate to work on projects that address issues of incontinence, give children a good start to life, address infant health issues and create partnerships on environmental initiatives.

Environmental stewardship

We are committed to improving the life of consumers by providing superior products while continuously striving for improvements in the environmental quality of our products by:

- Using raw materials that are safe for consumers and the environment;
- Supporting an integrated solid waste management approach;
- Producing products which are compatible with different solid waste treatment options;
- Working, where technically and economically feasible, to improve the environmental profile of our diaper and adult incontinence products.

Product innovations have not only delivered significant diaper performance improvements but have also resulted in measurable improvements in their environmental profile. The average diaper weight has reduced by around 40 per cent during the past 17 years. In an extensive life cycle assessment (LCA) analysis the impact of this weight reduction on the environmental profile of baby diapers along their entire product life cycle has been evaluated. Since 1987, 74 per cent of the recorded parameters for air emissions have decreased or remained stable and 60 per cent of the recorded parameters for water emissions have decreased.

The environmental impacts of these air and water emissions on global warming potential, acidification potential, nutrification potential and photochemical ozone creation potential are as much as 20 per cent less in 2004 than they were in 1987 (see graph 3).

Assessments have also been undertaken by both industry and independent authorities comparing the environmental impacts of disposable and cloth diapers. None of these evaluations have been able to establish categorically the environmental superiority of any one diaper option over the other.

The most recent and most comprehensive analysis has been undertaken by the UK Environment Agency, the results of which were published in May 2005. The major conclusions of the study were that:

- None of the diaper systems studied was more or less environmentally preferable;

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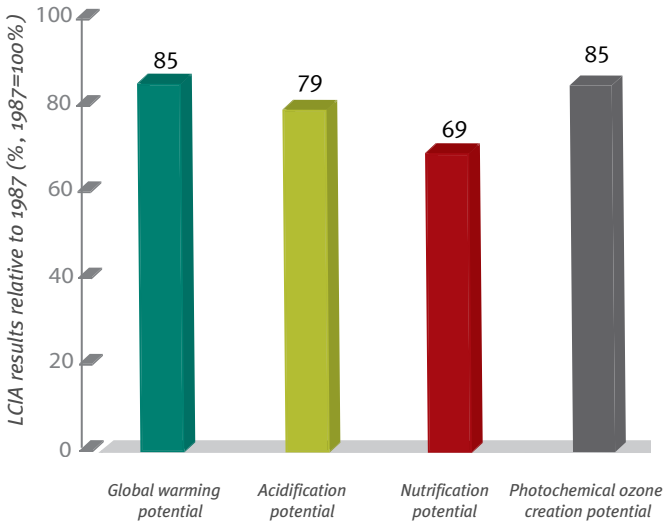
Graph 3

Trend for major environmental impact categories 1987-2004



- There was no significant difference between any of the environmental impacts of the disposable, home use cloth and commercial laundry diaper systems that were assessed in the study;
- The overall environmental impacts from waste management of any diaper system do not contribute substantially to the overall totals.

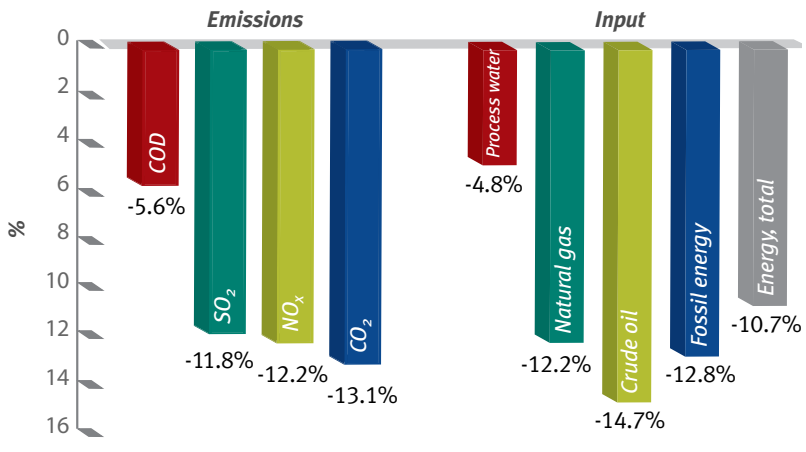
The study identifies where and gives recommendations on how manufacturers of the different types of diaper can improve the environmental impact of their products. We take these recommendations seriously and continue to explore how best our member companies can implement further improvements in the design and manufacture of disposable diapers as part of our continued efforts and commitment to sustainable development.

LCAs have also been undertaken on incontinence products. The most recent was undertaken in 2004 by an independent research institute in Germany, the IFEU (Institut für Energie und Umweltforschung). As a result of the introduction of superabsorbent polymers there has been a significant reduction in the use of raw materials and natural resources. The reductions in air and water emissions between 1995 and 2002 are shown in graph 4. For example:

- Fossil CO_2 emissions into the air have reduced by over 13 per cent;
- Consistently, the use of fossil energy has reduced by just under 13 per cent.

Graph 4

Reduction in air and water emissions and in use of raw materials for incontinence products 1995-2002



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Diapers and incontinence products in municipal solid waste

Much of the discussion about diapers and the environment has focused on their contribution to solid waste. On average in Europe baby and incontinence diapers comprise around 2-3 per cent of municipal solid waste and between 0.3 and 0.4 per cent of total solid waste. By comparison, food and garden waste contribute some 10-20 times more to the European average municipal solid waste stream.

Diapers and incontinence products are compatible with prevailing waste disposal and treatment methods:

- They can be safely disposed in landfills where they are readily compressed and contained;
- They can be incinerated in properly functioning incinerators;
- They can be processed through composting operations, provided there is appropriate technology available to separate the biodegradable, cellulose-based parts from the synthetic pieces;
- Soiled diapers can be processed using mechanical-biological treatment (MBT) methods.

Along with company-specific initiatives undertaken to reduce waste, as an industry we also play our part in finding new and innovative solutions to reducing waste in the community. Through our membership of the Association for the Sustainable Use and Recovery of Resources in Europe (ASSURRE), we are currently involved in two projects, the Mechanical-Biological Treatment project and the Sustainable Resource Management Through Sustainable Urban Management project. Through involvement with projects like these we want to improve our understanding of waste issues and, in partnership with others, be part of the solution.

Environmental policies and instruments

Local authorities, national governments, the European Union and international organisations are all increasingly using environmental policies and instruments to pursue environmental objectives. We support the introduction of measures which will help to reduce the overall environmental burden. There are some existing and proposed policy instruments however which are cause for concern for our industry as it is our view that they operate to discourage innovation or do not meet their objectives when viewed in a broader context.

Overall, we support the objectives of schemes such as eco-labels. In our experience however, such instruments can serve unintentionally to restrict rather than encourage environmental innovation. We do not support using financial instruments (such as incentives for particular products) as a way of reducing solid waste. In our view they distort markets, are against the spirit of free trade, have little to no impact on reducing the overall solid waste stream and simply transfer environmental impact from one area to another.

Prudent use of natural resources

The natural resources used to manufacture diapers and incontinence products are wood, crude oil, energy and water. The wood pulp used in baby diapers and incontinence products represents less than 1 per cent of total wood consumption. No wood from virgin tropical forests is used in the manufacture of absorbent hygiene products.

Pulp production is a high-technology multistage process which extracts the natural polymer cellulose from wood. It is largely self-sufficient from an energy perspective with by-products of the process being used to provide most (or even a surplus) of the energy for the production facility. Surplus energy can be used in combined heat and power plants.

Members of EDANA are committed to supporting sustainable management of forests based on sound ecological science, social responsibility and economic viability. We encourage third-party verification or certification of compliance with sustainable forestry practices.

The economic contribution

The size of the European market for disposable hygiene products is comparable with the US market. There are, however, significant variations between countries in terms of market penetration:

- In 2004 the annual volume of disposable baby diaper products sold was estimated to be

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20.25 billion units with an annual market value in 2004 of some 4.5 billion euros;

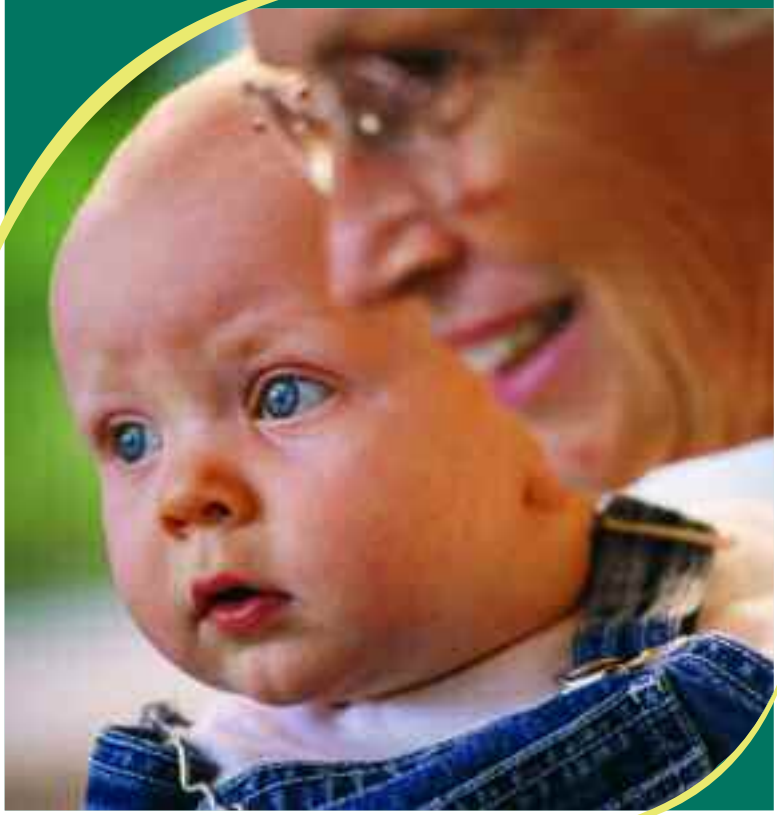
- Over the past 2 years the total European baby diaper market is estimated to have grown by 2.7 per cent. Many of the established European markets are mature now and given current demographic trends are only growing slowly. The newer markets have grown by 9 per cent in the same period and are expected to continue to grow in coming years;
- The total estimated volume of incontinence products sold in Europe, the Middle East and Africa in 2004 is around 5 billion units with an estimated revenue value to manufacturers of some 1.5 billion euros;
- In total, the members of EDANA who manufacture baby diapers and incontinence products employ some 100,000 people in Europe; making a substantial contribution to the economic wellbeing of families and communities in the countries of Europe. In 2003/04, some 20,000 of those were directly employed in the manufacture of absorbent hygiene products in Europe. This is matched by a similar number upstream within raw material supplier industries, not to mention those employed downstream in logistics and commercial operations.

"Sustainable development aims to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations."

Conclusion

- Disposable baby diapers and incontinence products have contributed to social progress in terms of quality of life, comfort, convenience, reduction in household chores and skin health benefits;
- Much has been done and still is being done to improve environmental performance in the production and design of baby diapers and incontinence products;
- Today's products are made in such a way as to make prudent and efficient use of natural resources;
- The manufacture and distribution of baby diapers and incontinence products contributes positively to the economies of Europe.

We believe we can demonstrate a good record of environmental improvement to date. We are not complacent, however. The challenge of improving the sustainability profile of disposable consumer goods like diapers and incontinence products is an ongoing one. By addressing all aspects of sustainability - social, environmental and economic - we are committed to improving the overall sustainability profile of baby diapers and incontinence products, while at the same time continuing to offer products that will improve people's lives around the world.



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1 | Introduction

In just about every walk of life today the question of sustainability is on the minds of policy makers, scientists, industrialists, local community groups, customers and environmentalists alike.

Issues related to sustainability affect everything that we do – where we live and how we live, where we work and what we do, what we consume, what our open spaces look like, how we travel, how we view the communities within which we live and how we think about the future. No generation before us has focused so sharply on these issues as we do today.

This report is our first ever attempt, as manufacturers of disposable baby diapers and incontinence products who are members of EDANA, to take stock of sustainability issues as they relate to our industry and our products. We seek to assess the impact of our industry on all aspects of sustainability - be they social, environmental or economic. We aim to bring together in one place comprehensive reference information about the impact of our products on quality-of-life considerations, our stewardship of resources, the environmental impact of our processes and products, and about the size of our industry and its contribution to the European economy.

We do so for two reasons:

1. to provide open and accessible information to external parties interested in sustainability issues relevant to our industry and products;
2. to provide a focus for our own thinking as an industry about how we can continue to make progress in improving the sustainability of our products and processes.

The material used in this report has been collated by the manufacturers of disposable baby diapers and incontinence products in Europe who are members of The Hygiene Absorbent Products Manufacturers Committee (HAPCO)[1] of EDANA, the international association serving the nonwovens and related industries. EDANA exists to create the foundation for sustainable growth of the nonwovens and associated industries through active promotion, education and dialogue.
It represents, protects and actively promotes the common interests of the nonwovens and absorbent hygiene products industries and their suppliers and provides the umbrella under which industry-wide initiatives of a non-competitive nature can be undertaken. Where data has not been available within the public domain we have used our best endeavours to make estimations in good faith whilst protecting commercial confidentiality. We have also drawn on a wide range of resources available within the public domain and as a reference for readers have listed those resources in Appendix 2[2].

Comments on this report are welcome and should be directed to:

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1 For a full list of HAPCO members see www.hapco.edana.org/contacts. For contributors to this report see Appendix 3 of this document.
2 All data referred to throughout this document has been sourced from the references listed in Appendix 2 or from information supplied by member companies.

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What is sustainable development?

Sustainable development aims to enable all people throughout the world to satisfy their basic needs and enjoy a **better quality of life without compromising the quality of life of future generations.** Although the idea is simple, the task is substantial. It means meeting four objectives at the same time:

- Social progress which recognises the needs of everyone;
- Effective protection of the environment;
- Prudent use of natural resources;
- Maintenance of high and stable levels of economic growth and employment.

Source: Sustainable Development - The Government's Approach - delivering UK sustainable development together - www.sustainable-development.gov.uk

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2 | Sustainable development

The concept of sustainable development or sustainability has been in existence for a number of decades. It seeks to reconcile economic development with environmental protection and social responsibility around the world. The 1987 Bruntland Report of the UN World Commission on Environment and Development offered a definition of sustainable development which has informed much of the debate and discussion that has occurred in ensuing years. It defined sustainable development as 'development that meets the needs of the present, without compromising the ability of future generations to meet their own needs'.

For the purpose of this report we take as our starting point the elaboration of the 1987 definition which has been adopted by the UK government (see page 16).

This is the first ever Sustainability Report that has been prepared by EDANA. In making it, EDANA has in particular focused on:

- The contribution disposable baby diapers and incontinence products have made to social progress which recognises the needs of everyone;
- The actions our industry takes to ensure and improve environmental stewardship within our processes and our products;
- The extent to which our industry is making efficient and prudent use of natural resources;
- The contribution our industry makes to the maintenance of high and stable levels of economic growth and employment.

It is our hope that this report helps demonstrate that:

- Disposable baby diapers and incontinence products undoubtedly have contributed to social progress in terms of quality of life, comfort, convenience, reduction in household chores and skin health benefits;
- Much is being done to improve the environmental performance of the production, use and disposal of baby diapers and incontinence products;
- Today's products are made in such a way as to make prudent and efficient use of natural resources be it in the raw materials used in the products or the processes engaged to make them;
- The manufacture and distribution of baby diapers and incontinence products contributes in a variety of ways to the economies of the countries of Europe.

We recognise however that the challenge of improving the sustainability profile of disposable consumer goods like diapers and incontinence products is an ongoing one. We believe we can demonstrate a good record of improvement to date. Innovation has delivered products that give better skin care and better performance, with reduced resource use and reduced environmental impact; all at an affordable price. However, this is still work in progress; sustainability is not static, but rather a continuous process of improvement and balance between its three pillars. By addressing all aspects of sustainability - social, environmental and economic - manufacturers are committed to improving the overall sustainability profile of baby diapers and incontinence products, at the same time helping to improve people's lives around the world.

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"Modern disposable baby diapers and incontinence products have made an important contribution to the quality of life of millions of people."

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3 | The social contribution

The development of modern baby diapers and incontinence products

→ Baby diapers

Before 1936 diapers were mainly either cotton-based ribbed towelling or a cotton muslin-type material both of which, with laundering, could be reused. These typically took the form of a square of material which was wrapped around the baby and fixed in place with safety pins. The diaper was then covered with reusable plastic or rubber pants with elasticised leg openings.

In the late 1930s, early forms of tissue-based disposable under pads and diaper inserts were introduced in Sweden. Developed by Pauliström Bruk, a number of versions of this basic product emerged between 1936 and 1942 including the use of rubber pants to hold the cellulose pad in place. In 1950 the company introduced a new version of the product based on bleached cellulose wadding with a knitted-mesh outer layer which could be inserted into a holding pocket in a rubber pant. In the same year Johnson & Johnson introduced a rectangular under pad product based on cellulose wadding with wet-strength tissue as the cover-stock and plastic as the backing. In 1957 Mölnlycke (now SCA) introduced a 'pear-shaped' insert formed from defibred wood pulp with a knitted-mesh cover.

The convenient disposable baby diaper is a relatively new invention; credited to Marion Donovan who in 1950 cut her shower curtain into plastic envelopes into which she slipped absorbent material, using snap closures to secure the diaper on her baby. This form of disposable diaper was an immediate success, due largely to the time saving attractions it offered to the increasing number of working mothers. However, the move towards disposable baby diapers began in earnest in 1961 when Procter & Gamble introduced the first Pampers in the USA, based on cellulose wadding with a plastic backing and a nonwoven topsheet. Subsequent developments saw the introduction of fluff pulps, the addition of adhesive tapes and the use of plastic backsheets.

Further developments in the mid-1980s owed much to the availability of improved superabsorbent polymers and better methods to add the polymer to the pulp core, as well as innovations such as frontal and resealable tapes and elasticised waists. The introduction in 1989 of the first disposable training pants by Kimberly-Clark and of diaper pants in 1991 marked the start of an extension of the normal diapering period into the child's toilet-training phase. The distinction between training pants and pant diapers originally related to the absorbent capacity of the product, with training pants having more limited absorption capacity. This distinction is less relevant now, with both types of product available with sufficient capacity for night-time use.

Disposable diapers today are much thinner and more absorbent than their earlier counterparts and as a result are more effective. They are more comfortable for the infant to wear and more convenient for parents to use. In addition, their usage has been accompanied by a marked reduction in skin irritation in individual children and a decrease in the spread of infectious diseases amongst children in group care environments.

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→ Incontinence products

Absorbent products specifically designed for adult incontinence are the newest category of hygiene products. Their use in Europe started in the late 1960s. The design is based on the technology developed for baby diapers and feminine hygiene protection. The key performance requirements such as protection from leakage, comfort, discretion and skin dryness, are similar in kind but differ in degree according to the severity of incontinence. A wide range of products is now available to cover the needs of incontinence sufferers in different sizes to fit different body shapes and levels of absorbency.

Originally, adult incontinence diapers were mostly used in nursing homes and hospitals where they brought considerable advantages to both patients and nursing staff: increased comfort for the user, fewer skin irritations, fewer infections, easier handling for the staff, less washing, reduced odour problems and generally a more hygienic environment for the care of patients.

In recent years, however, the market for incontinence products outside institutions has grown considerably. Current growth rates in institutional markets are now smaller than in the home care environment where there is now much greater awareness of the benefits of incontinence products and much less stigma about their use than in earlier decades. They are an important tool in enabling people with incontinence problems to manage within their own homes rather than having to resort to nursing care.

Product description

Baby diapers and incontinence products are engineered to absorb and contain urine and faeces of babies, children or adults. They are designed to keep the skin dry so that they are isolated from clothing, bedding and the surrounding environment. The products need to provide maximum comfort to the user and maximum convenience to the carer.

Baby diapers and incontinence products are made under high-quality production control standards with over 60 years of safe use by millions of people. They are made from readily available materials with proven safety profiles that are widely used in a variety of everyday consumer products.

→ Baby diapers

The principle requirement of baby diapers is to provide an effective absorbent structure to receive, absorb and retain urine and faeces during the first 2-3 years of the baby's life. Today, the main type of disposable baby diaper is the taped version which accounts for more than 90 per cent of the European market. Training pants and pant diapers are used to help toddlers with toilet-training by providing back-up protection in case of accidents in the final stage of toilet-training.

Present-day products have a layered construction making it possible to assign specific functions to different layers or materials with the complete product.

Schematic overview of a modern disposable diaper

Topsheet:
Allows instant transfer of the urine from the contact point on the top surface, through to the acquisition layer immediately below and provides a contact layer to protect the baby's skin from chafing or irritation. It provides, together with the backsheet film, a containment of the structure of the diaper both when wet and dry. The topsheet, typically made of polypropylene (PP) nonwovens, is in intimate contact with the baby's skin, so it should be very soft to ensure that there is no skin abrasion. It is also the first layer to have contact with the urine flow and needs therefore to be instantly wettable and have high fluid permeability. Some manufacturers apply a lotion on to the topsheet to provide additional skin care benefits.

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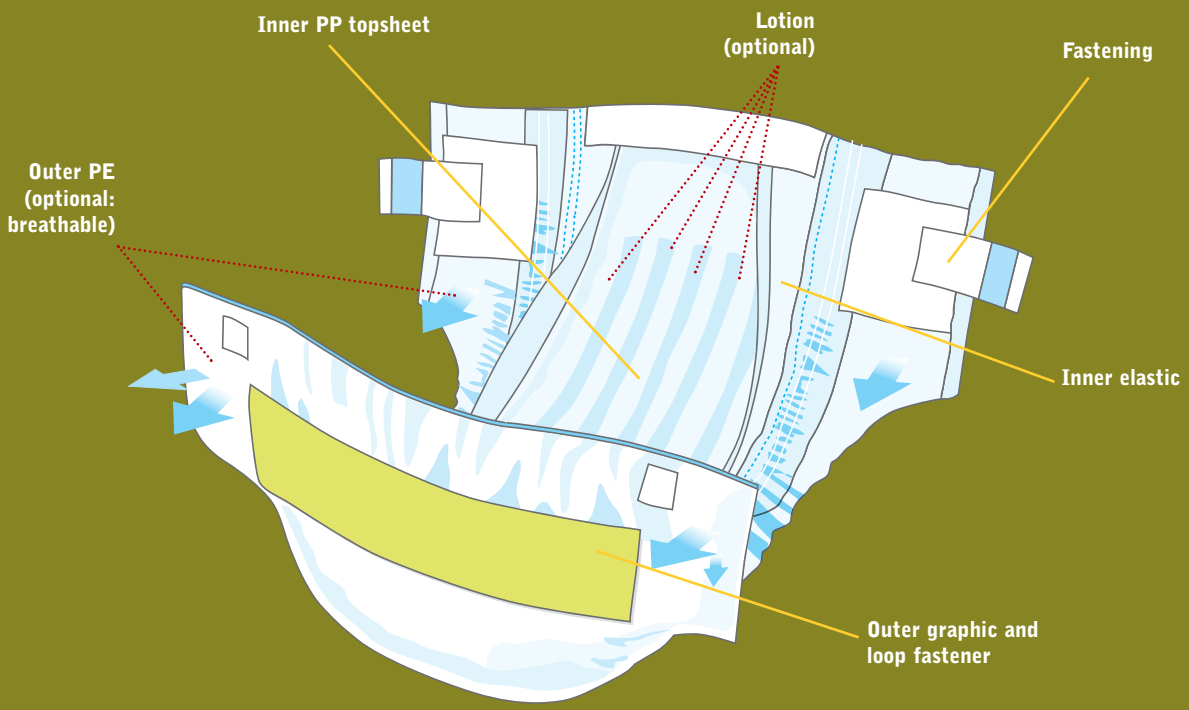

Acquisition/distribution layer(s) (ADLs):

Receives the urine flow through the topsheet and effectively transfers it to the storage part of the ADL thereby making best use of the core. A number of different structures and materials are used for this.

Tissue wrap layer:

Used in some diaper products around the absorbent core structure or the storage layer. This serves to contain the dry structure during manufacture and assists in preventing distortion or collapse of the core when saturated with liquid.

Absorbent core structure:

Is the urine storage layer and is the key component in a modern diaper. It receives the urine that has been transported through the topsheet, distributed by the ADL and transferred to be locked within the core structure. It has to absorb the urine as fast as it is received and has to allow distribution of the liquid through the structure so that the whole core is utilised. There are normally two principal components in a modern diaper core – fluff pulp and superabsorbent polymers (SAP). The early diaper core was 100 per cent fluff pulp. It acted like a sponge; consequently, just a small amount of pressure to a saturated core could cause the absorbed liquid to be released. The superabsorbent polymers used today are almost entirely based on cross-linked polyacrylate polymers. They now comprise 25 to 30 per cent of the content of the core and provide the 'fluid-locking' mechanism in the core – fluff pulp comprises up to 50 per cent of the core. On contact with the urine the polymer becomes a gel which can absorb many times its own weight in fluid; the fluid is not released, even under pressure.

Backsheet:

Is either polyethylene (PE) film or, more recently, a nonwoven/film composite. Its role is to prevent wetness transfer to the baby's bed or clothes. It plays an important role in containment of the whole structure, especially when wet. This is usually the first material the parent comes in touch with on removing the diaper, so softness is perceived as important. The backsheet has to be sufficiently robust to be able to fulfil its purpose, but also needs to be thin and noiseless when the baby moves. Breathable film backsheets are widely used in modern-day absorbent products manufactured in Europe. These can help to keep the skin drier, which has been shown to have a positive impact on the skin condition in the diapered area, particularly in terms of occlusion, diaper dermatitis and *Candida albicans* superinfections.

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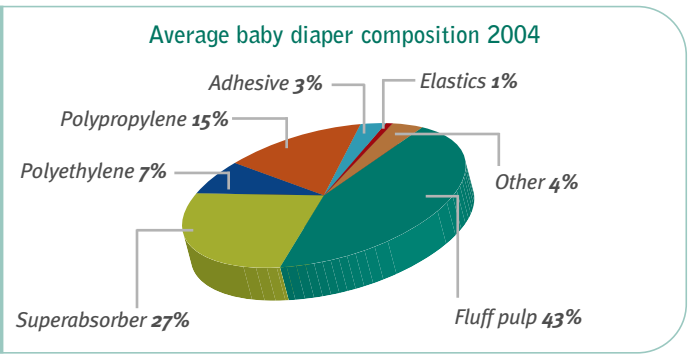
Baby diapers come in different sizes ranging from newborn babies sizes up to a size for 24-36 month old babies. Averaging across all sizes, a baby diaper weighs approximately 40-42 grams and is primarily made of pulp (fluff pulp), superabsorbent polymer (SAP), polypropylene (PP), polyethylene (PE), as well as minor amounts of tapes, elastics and adhesive materials. Over the years diapers have become thinner, lighter, and more efficient. The current average diaper composition is given in graph 5, below.

→ Incontinence products

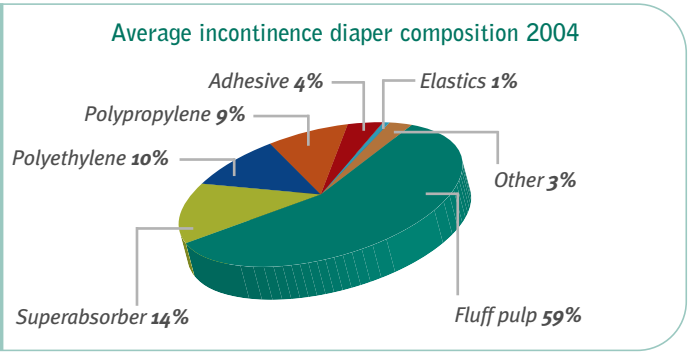
Incontinence products have the same requirements as baby diapers – that is to provide an effective absorbent structure to receive, absorb and retain urine and faecal waste from adults without leakage or skin irritation and with minimum odour. This enables users not only to manage their incontinence effectively and with dignity but also to lead as normal a life as possible. Several different products are available, catering for differing degrees of adult incontinence, from light to moderate and to heavy. The main product types are categorised as two–piece systems (pad and pant) for the whole spectrum of incontinence needs and insert pads, body-shaped, plastic–backed pads either fitted to the body in specially designed knitted stretch briefs or (for light incontinence) used in normal briefs.

An average adult incontinence product uses practically identical materials to baby diapers but in different proportions. As with baby diapers, adult incontinence products have also become thinner, lighter, and more efficient over the years. The average composition is illustrated in graph 6, below.

Graph 5



Graph 6



Societal developments and lifestyle

→ Baby diapers

Modern disposable baby diapers and incontinence products have made an important contribution to the quality of life of millions of people. Pervasive in their availability and acceptance, they provide convenience, comfort and skin care benefits. In fact, in a survey carried out by the Louis Harris Research organisation in 1997, respondents with children voted disposable diapers as the second greatest improvement in contemporary life (the first being the automatic washing machine), compared with the generation that went before them.

Since their introduction modern single-use diaper products have improved steadily through scientific advances in design and basic raw materials, becoming lighter, more compact, more absorbent and easier to use. Originally they were promoted for use on journeys, holidays and in temporary situations but it was not long before parents realised how practical and convenient they were for everyday use. Today it is estimated that more than 95 per cent of all parents use them – and it is generally recognised that:

- Modern disposable diapers are healthier for the infant's skin because their usage results in reduced skin rash incidences, skin irritation and infections;
- Their softness, lightness and the breathable nature of some of the raw materials provide for superior comfort for the baby;
- They are easy to put on and remove, taking up less time, for example, than using cloth diapers;

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- They are convenient because they eliminate the need for constant laundering, boiling and drying.

Disposable baby diapers have become the method of choice for nearly all families across Europe. There can be little doubt that the convenience of disposable diapers is a huge benefit in today's busy lifestyles where time is a precious asset. They lessen the burden of domestic chores, freeing parents to spend more time on other activities in their family, social or economic lives.

→ Incontinence products

Many otherwise healthy, active individuals suffer from incontinence. It is a distressing and isolating condition. The exact number of people suffering from the problem is not known, but the total number of people affected may be far greater than current estimates. This is because many people fail to report it, even to their own doctor.

Women are twice as likely as men to have this condition as a result of the impact of pregnancy on pelvic muscle control. In addition, in later years of life, when incontinence is most commonly suffered, it is often caused by other conditions, such as stroke or senile dementia.

The inability to control urine is one of the most unpleasant and distressing problems from which a person can suffer. Faecal incontinence (also called bowel incontinence or anal incontinence) affects people of all ages. It is defined as the involuntary loss of solid or liquid stool sufficient enough to result in impaired quality of life for the individual. Both forms often cause isolation, depression and physiological problems and can significantly impact on social and work related aspects of the sufferer's life. In addition, incontinence can be a heavy burden for family caregivers and the community. It is often a major contributing factor in deciding that ageing parents are no longer able to live independently and need a level of care that can only be provided in nursing homes.

Adult absorbent products are used by both men and women to manage

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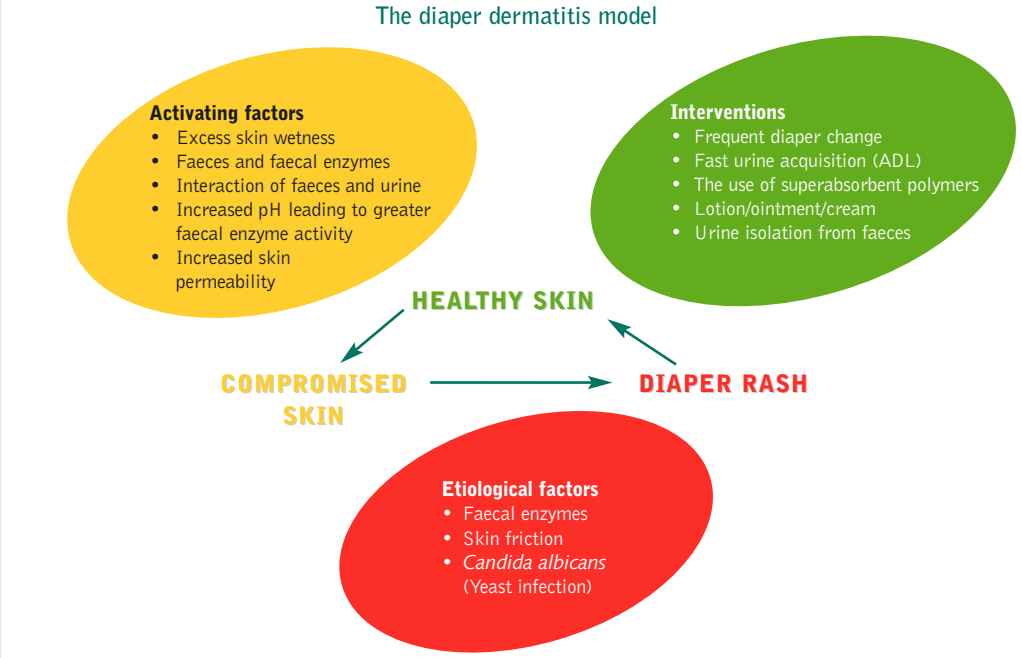
their incontinence, whether resulting from temporary or chronic illness or disability. A wide range of products is available to suit varying degrees of incontinence, disability and lifestyle. These modern products are largely based on the same technology and materials developed for baby diapers. They are discreet and can be used easily at whatever age at home, in hospital or in an institution.

They have had an enormous positive impact on the quality of life of people with incontinence. They provide hygiene, cleanliness, comfort and above all, independence. They also save them or their carers the unpleasant task of changing and disposing of heavily soiled products. They allow users to maintain their sense of dignity and enable them to get out, work, take part in social activities and lead a full and satisfying life. The importance of these products in addressing the problems created by incontinence is recognised by the fact that in many countries incontinence products are available on prescription from medical professionals and the costs are consequently reimbursed either through health authorities or health care insurers.

Graph 7



Skin health benefits

Diaper dermatitis (diaper rash) is a non-specific term used to describe a wide range of inflammatory reactions of the skin in those areas of the body covered by diapers. Secondary superinfections with *Candida albicans* are also common when the skin in the diaper area has been compromised by diaper rash.

Diaper dermatitis is related to excessive skin wetness. Reference to it is found in the medical literature as early as 1877 (see References: Skin health improvements, p. 52). Published clinical and laboratory studies have shown that increased skin wetness, higher 'skin pH alkalinity', and the mixing of urine with faeces all increase the risk of developing diaper rash. Enzymes in the faeces can attack the skin, especially if it is already compromised by hydration. Ureases, also contained in the faeces, can convert urea in the urine to ammonia, which increases the pH and enables the activity of the lipases and proteases enzymes.

It is generally recognised that diaper dermatitis:

- Is experienced by almost every child of diaper-wearing age – it is estimated that one quarter of all

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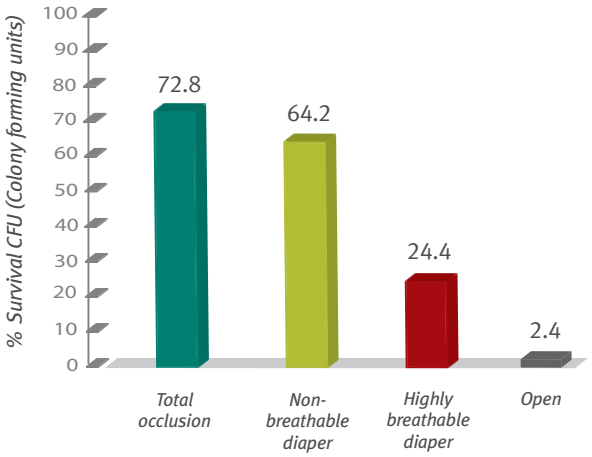
babies experience diaper rash in their first four weeks of life when the body has yet to develop its resistance to infection;
- Comprises a series of more or less severe inflammatory reactions in the skin covered by diapers;
- Is frequently associated with *Candida albicans* superinfection requiring medical intervention;
- Is primarily caused by irritants in the urine and faeces.

Graph 7, on the previous page, illustrates the activating factors and scientific causes of diaper dermatitis and the interventions that can be taken to reduce its incidence.

Graph 8

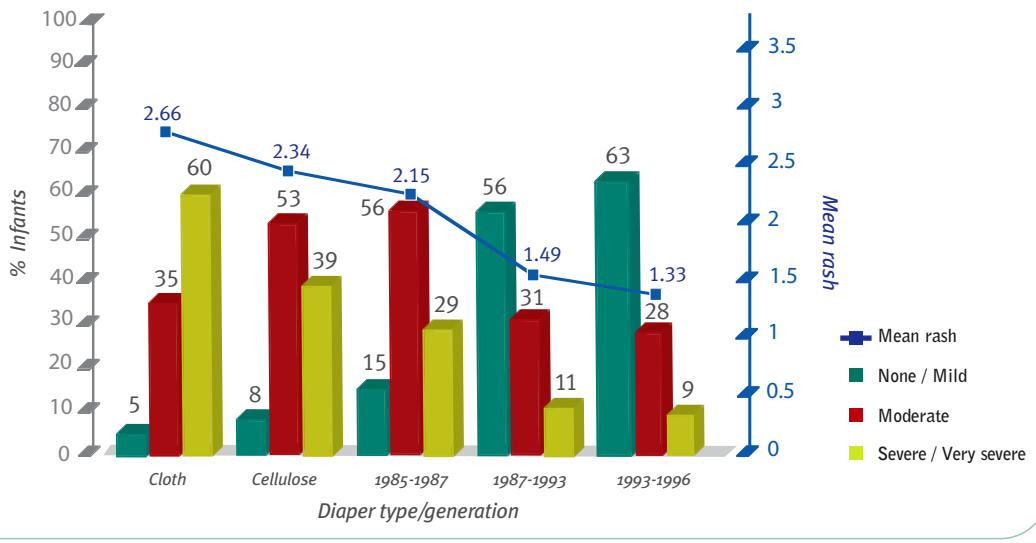
Survival of *Candida albicans* on human skin underneath breathable and non-breathable diapers



Over the last fifteen years baby diaper technology has advanced considerably in the following ways:
- The introduction of superabsorbent polymers (SAP) has created an improved core structure. SAPs are capable of absorbing many times their own weight in liquid. They help to hold the urine away from the skin and faecal enzymes. Comprehensive scientific safety testing on these materials together with a long and successful history of use has assured that they are non-irritating and non-allergenic, and safe for consumers;
- Innovative topsheet material through which urine quickly penetrates. This provides increased efficiency in the transfer of liquid as well as creating a barrier between the moisture and the surface of the skin. The topsheet has also been made softer and its weight has been reduced over time;
- Breathable, microporous outer covers which keep the skin drier

Graph 9

Product innovation and diaper rash reduction



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and have been shown to have a positive impact on the skin condition in the diapered area, particularly in terms of occlusion, diaper dermatitis and *Candida albicans* superinfections.

The scientific evidence that these innovations have produced real benefits in skin care, dryness, and leakage protection is well established (see References, Skin health improvements pp. 52-53).
Clinical studies have demonstrated the ability of disposable diapers based on SAP technology to keep the skin drier and that a more stable skin pH with less dermatitis is achieved with disposable diapers than with home-laundered cloth diapers. In addition, the isolation of urine from faecal material in diapers facilitated by the SAP helps minimise the formation of ammonia from urea. SAP technology has also been tested in other clinical studies, using infants with atopic dermatitis (naturally dry and sensitive skin) and in children in day care, to further verify its compatibility with these conditions and the skin care benefits.

Babies wearing highly breathable disposable diapers have also been shown to experience significantly less diaper dermatitis compared with infants wearing non-breathable diapers in a series of double-blind clinical studies. Severe diaper dermatitis, including confirmed infection with *Candida albicans*, was reduced by up to 50 per cent in the groups of children wearing breathable diapers. Controlled microbiological evaluation confirmed the inhibitory effect of breathable diapers containing superabsorbent polymers on the survival of *Candida*.
It is the view of many paediatricians and nurses that the number of infants seen with diaper dermatitis is declining over time. Indeed, a review of clinical studies conducted over the past 15 years in the US and Western Europe with over 6,500 babies supports the view that the diapered skin condition of the baby population has improved over the years. Since socio-economic conditions did not change substantially over these years in the regions in which the clinical studies were conducted, it is reasonable to assume that better diaper technologies have played a key role in the improvement of the skin condition of diapered infants, in particular in the large decrease in severe diaper rash cases reported.

The industry's commitment to safety

The principle that our products must be safe for consumers, employees and the environment is paramount within our industry. It guides us in raw material selection, product design, manufacturing, consumer communications and considerations relevant to the disposal of our products.

Manufacturers must comply with all appropriate technical standards, regulatory prescriptions and safety guidelines. In order to ensure the safety of the raw materials used in the manufacture of these products:

- Materials are rigorously evaluated, often with the help of specialised laboratories for toxicological evaluation, skin compatibility (ability to induce allergy/irritation), potential contamination, stability and ageing tests;
- Finished products undergo visual inspection for absence of contamination, product integrity tests under simulated in-use conditions and routine bio-burden checks;
- Manufacturers also carry out in-use testing on incontinence products and baby diapers to ensure dermatological compatibility.

European Union legislation provides the legal framework of manufacturers' obligations in this respect (e.g. Directive 92/59/EEC & 2001/95/EC on general product safety) and are implemented at member state level. Adult incontinence hygiene products are classified as Class I medical devices by the European Medical Devices Directive; 93/42/EEC. In order to comply with the European Medical Devices Directive there are specific ISO/CEN technical standards requirements for biological safety testing (the ISO 10993 series) which should be followed. In addition, some absorbent hygiene products may contain components which can fall under a specific directive with its own regulatory and safety requirements; for example, the lotion part of lotionised diapers has to comply with the European Cosmetics Directive 76/768/EEC and its amendments.

Our industry does more than simply comply with the legal framework to ensure that our products are safe. We conduct our own safety evaluation programmes

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and as individual companies we continuously monitor the market, our products in use and any concerns consumers may have in using them. It is not unusual, for major product changes or on the launch of new products, for independent experts to be consulted to ensure that all aspects of safety are considered.

All manufacturers have systems in place to:

- Receive communications from consumers – usually using free phone numbers featured on product packages;
- Receive, investigate and take appropriate actions in response to consumer complaints;
- Answer enquiries from consumers and other stakeholders.

In addition, manufacturers have product recall procedures in place to respond to an adverse incident which affects the quality or safety of our products. In reality these are extremely rare events. A product recall action for baby diapers or incontinence products has never been necessary for the products manufactured and distributed by our member companies, giving testament to the effectiveness of the product safety testing and assurance systems that are in place.

Disposable baby diapers and incontinence products have an extremely good safety record. They have been proven to be safe for their intended use and have a long history of safe use by millions of people. The materials used in them also have a long history of safe use in many other product applications in society. So, for example, the polyethylene, polypropylene and polyester used for the outer cover and the inner liner, are also used in food wrap, beverage containers, clothing and plastic bags. Superabsorbent polymers are used in food packaging, cable wrapping, sealing components and horticultural and agricultural products. All of these materials have proven safety profiles.

The industry's commitment to corporate social responsibility

The manufacturers of disposable baby diapers and incontinence products recognise their responsibility for operating in a responsible manner in all aspects of their business. While each company approaches these responsibilities in their own way reflecting their individual values and cultures, we strive to ensure that as an industry we:

- Respect and exceed the law and regulations wherever we do business;
- Respect human rights as they relate to our own employees and to broader issues such as child labour and worker exploitation;
- Operate our facilities with due care and consideration to the health and safety of the people within them;
- Encourage diversity, equal opportunities and the development of human potential within our employee base;
- Deal fairly with our suppliers;
- Demonstrate active management of environmental stewardship.

We recognise too that we do not conduct our business in a vacuum; that we live and work within communities. Our member companies make many contributions to the communities where they operate. Some examples of the types of programmes supported are activities that:

- Give children a good start in life;
- Address infant health issues;
- Address issues of incontinence and bed wetting;
- Support the development of better child care facilities;
- Create partnerships on environmental initiatives;
- Support local environmental and regeneration improvements;
- Facilitate employee involvement in local community activities.

Some of our member companies already produce their own individual sustainability reports; further information on specific company initiatives is available in these reports or on company websites.

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"Adult absorbent products have an enormous positive impact on the quality of life of people with incontinence. They provide hygiene, cleanliness, comfort and, above all, independence."

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4 | Environmental stewardship

Life cycle assessment

Life cycle assessment (LCA) has become established in recent years as an independent tool for the measurement and communication of environmental progress in product development or factory eco-auditing. It is broadly recognised by authorities, regulatory bodies, consumer organisations and other relevant stakeholders. It is not, however, the only tool for managing environmental performance; others include risk assessments, life cycle costs and cost-benefit analyses. In the life cycle assessment approach the product is viewed holistically 'from its cradle to its grave', that is from harvesting the natural resources to the ultimate disposal of the product after use. This ensures that all aspects of a product's impact can be analysed and assessed.
The methodology of life cycle assessment has matured over the years so that it now includes both an inventory and an impact assessment. The importance of life cycle assessment is underscored by the international standardisation efforts and developments taking place through the ISO 14040 series. Most EDANA member companies have been involved from the very beginning of the standardisation processes for LCA and are now actively involved in the first revision of the LCA ISO standards.

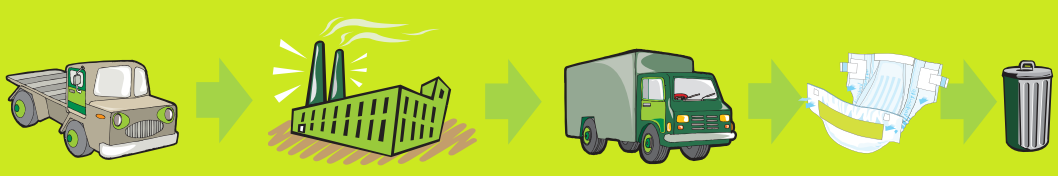
LCA has provided diaper and incontinence product manufacturers with a rigorous and credible tool for understanding the potential environmental impacts of their products and processes and helps to provide a framework for future improvements.

→ Disposable baby diapers

Product innovation such as the introduction of superabsorbents not only delivered significant diaper performance improvements but also resulted in measurable improvements in the environmental profile of baby diapers. As a result of such developments, the average diaper weight has been significantly reduced by around 40 per cent in a period of 17 years, from around 68 grams in 1987 to approximately 40–42 grams in 2004. In addition, significant advances have been made in packaging, truck loading and transport efficiency which have all contributed to achieving improved environmental performance.

Using the life cycle assessment (LCA) technique, the impact of weight reduction and of product composition changes on the environmental profile of diapers has

Life cycle assessment stages - from raw material extraction to disposal



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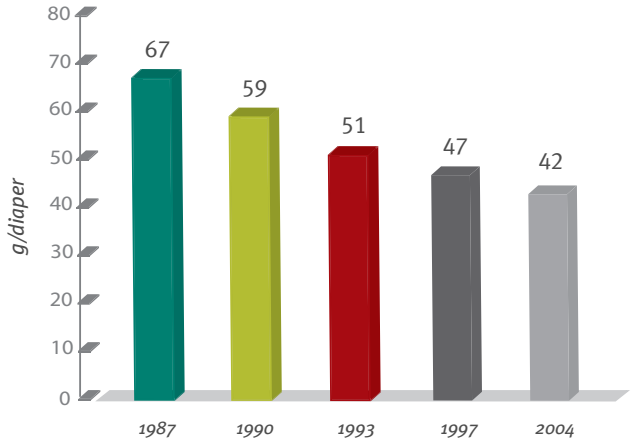
Graph 10

Average diaper weight reduction 1987-2004



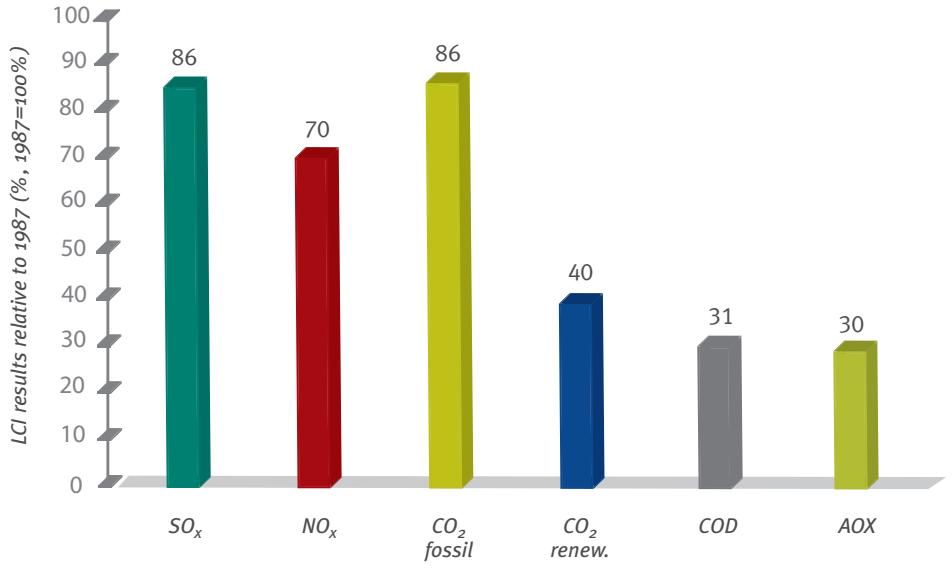
been examined along the entire product life cycle. In the life cycle inventory (LCI) phase of the assessment some 170 parameters were defined relevant to emissions into air and into water. Their combined potential impact on the environment was then evaluated in a life cycle impact assessment.
In addition to publicly available databases on aspects such as energy production and transport, much of the data used is industry-specific. These data sets contain both geographic and temporal spread of the relevant processes; the quality of the data is in line with standard requirements for LCAs. As usual when using the LCA technique, only differences in results that are larger than a certain percentage (here 10 per cent) are reported as significant. Smaller variations in results may indicate a trend, but it is not possible to state with certainty that they are significant as they may occur due to variability in data or in the calculation process. The results can be summarised as follows:

Emissions into air

Overall, 74 per cent of the 83 recorded parameters for air emission decreased or remained stable over time. Fossil-based CO_2 decreased by approximately 14 per cent and renewable-based CO_2 emissions decreased by more than 60 per cent. This was primarily due to the significant reduction in pulp content resulting from innovation in product design. For NO_x a significant improvement was recorded in the order of 30 per cent. SO_x decreased by 15 per cent, while ammonia emissions, for example, remained stable.

Graph 11

Trend in water and air emissions 1987-2004



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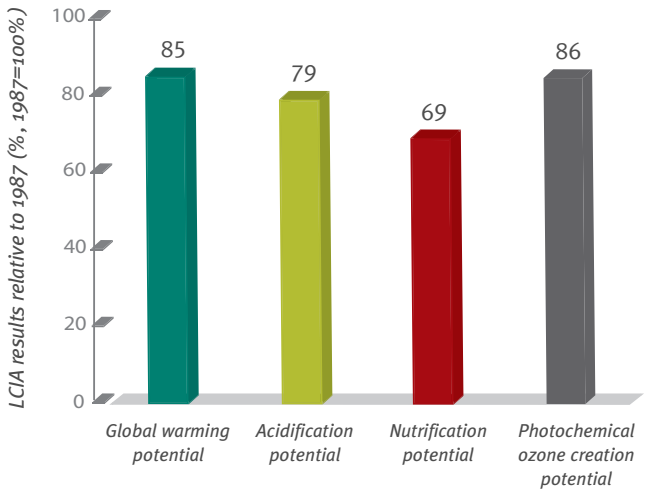
Graph 12

Trend for major environmental impact categories 1987-2004



26 per cent of the parameters showed an increase, amongst them unspecified metals which increased by a factor of two. This is mainly due to the increased use of superabsorbent polymers and polypropylene nonwoven materials in diapers and incontinence products.

Emissions into water

In this category, some of the most significant improvements have been recorded. Important aggregated parameters such as chemical oxygen demand (COD) and absorbed halogenated organic compounds (AOX) decreased by approximately 70 per cent. This is mainly a result of changes in the bleaching process, the significant reduction in pulp content and its replacement by superabsorbent polymer. Overall, 62 per cent of the 87 recorded parameters improved or remained stable and 38 per cent of the parameters increased, amongst them inorganic compounds such as sulphates (by 23 per cent); this was due to the increased usage of superabsorbent polymer.

Life cycle impact assessment

The technique of life cycle impact assessment (LCIA) was then used to examine the potential environmental impacts of air and water emissions. Four reliable impact categories have been evaluated (global warming, acidification, nutrification potential and photochemical ozone creation potential). In all impact categories improvements were achieved (see graph 12): acidification and nutrification were significantly reduced by 20 per cent or more; global warming (emission of greenhouse gases) and photochemical ozone creation potential ('summer smog') potentials also improved by around 15 per cent. Other impact categories such as human and eco-toxicity potentials were not included as the methods for evaluating those impacts are still in development and therefore judged to be less reliable.

In summary, the changes made to the composition of diapers and the consequent reduction in pulp usage has led to significant weight reduction over the past 17 years. This in turn has led to considerable reductions in water usage and air emissions. Although some of the recorded indicators increased or remained stable, the majority of indicators (68 per cent) showed a significant improvement since 1987. Product innovation during the last 17 years therefore not only improved product performance of disposable diapers, but went hand in hand with environmental improvements for the majority of the examined indicators.

→ The environmental impacts of disposable and cloth diapers

There has been an ongoing debate about the relative environmental impacts of disposable and reusable cloth diapers. Some comparisons have tended to focus mostly on the solid waste aspect, specifically on the burden of disposable diapers on landfills. However, the environmental considerations of any consumer product, including diapers, need to be evaluated in the context of the product's entire life cycle, from the use of natural resources, through manufacturing, product use and disposal, not merely at a single phase. Choosing a diaper system on the basis of only one environmental parameter, such as solid waste, ignores the contributions of other important parameters such as air and water pollution and use of energy and water.

Independent organisations in several European countries have evaluated both diaper systems, cloth and disposable. They have concluded that both systems impact the environment, albeit in different ways, and that the environmental superiority of any one diaper option over the other cannot be determined.

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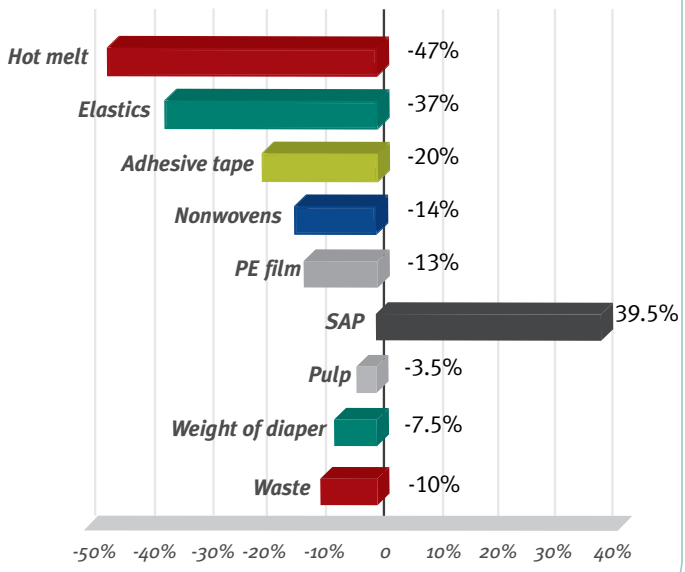
This has also been demonstrated and quantified in numerous LCI studies that have been conducted in many countries around the world. There are various numerical differences in these studies as a result of different methods and assumptions, different geographies and differences in regional infrastructure. The overall diaper LCI record, however, supports the general conclusion that none of the diaper options is environmentally superior in all its aspects. Both diaper systems cause emissions and use some energy, water and natural resources. The overwhelming majority of diaper life cycle studies conclude that cloth diapers consume more water and produce more waterborne emissions than disposable diapers, while disposables produce more solid waste and consume more natural resources.

Graph 13

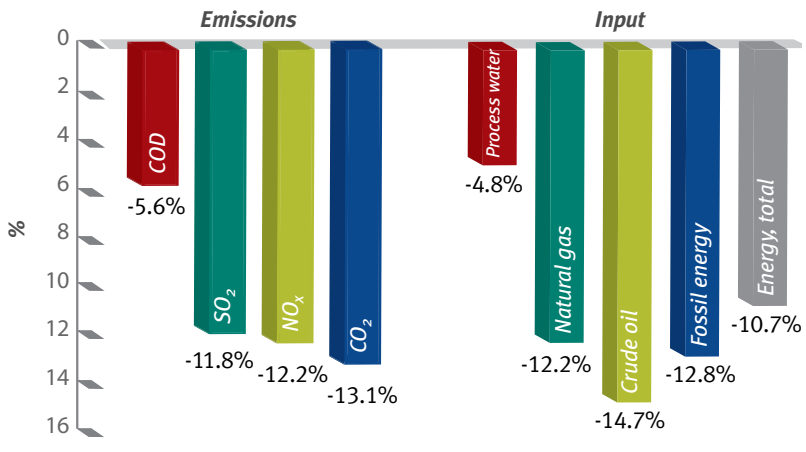
Incontinence product composition change between 1995 and 2002



This conclusion has been recently confirmed by a comprehensive, independent LCA published in May 2005, commissioned by the UK government's Environment Agency. The study comprised a detailed life cycle assessment of the environmental burdens associated with the production, use and disposal of cloth and disposable diapers. In this assessment the impact of three diapering systems were considered: cloth diapers with home wash, cloth diapers with commercial laundry and disposable diapers.
The study confirms that there is no significant difference between any of the environmental impacts of the disposable, home-use reusable and commercial laundry systems that

Graph 14

Reduction in air and water emissions and in use of raw materials for incontinence products 1995-2002



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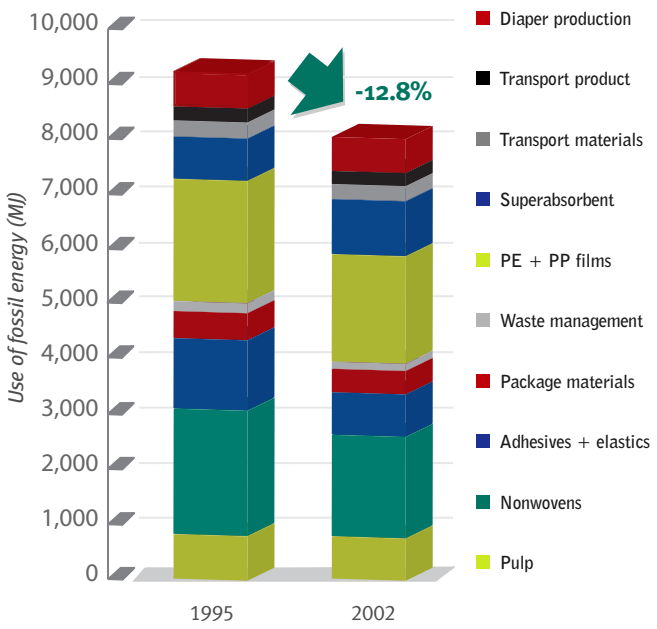
Graph 15

Fossil energy use for incontinence products 1995-2002



were assessed. None of the systems studied were found to be environmentally preferable. The study found that for all three systems the impacts from waste management do not contribute substantially to the overall totals. It also concluded that the global warming and non-renewable resource depletion impacts over the 2.5 years in which a child is assumed to be using diapers are comparable with driving a car between 1300 and 2200 miles.

The study identifies where and gives recommendations on how manufacturers of the different types of diaper can improve the environmental impact of their products. We take these recommendations seriously and continue to explore how best our member companies can implement further improvements in the design and manufacture of disposable diapers as part of our continued efforts and commitment to sustainable development.

The disposable diaper industry accepts its responsibility towards the environment. As reported in previous chapters, we have made considerable advances in the reduction of raw materials, water, and energy usage in baby diapers. Over the past 17 years as a result of product innovation the average weight of a diaper has been reduced by around 40 per cent, resulting in significant advances in several environmental impact categories such as global warming potential and photochemical ozone creation potential.

→ Incontinence products

In 2004 the absorbent hygiene products industry conducted a life cycle inventory (LCI) analysis of an adult incontinence diaper. This was conducted by an independent research institute, the German IFEU (Institut für Energie und Umweltforschung), comparing an equivalent all-in-one incontinence diaper product from 1995 with one from 2002.

The LCI analysis confirmed that there has been very positive progress over the 7 year period. Graph 13 shows the change in material composition between the years 1995 and 2002. Bars at the left side illustrate reduction and bars to the right illustrate an increase. The functional unit of the LCI is consumption over one year of adult diapers for one person suffering average incontinence problems; estimated to be 1,700 pieces. The changes in product composition resulted in an improvement in key parameters for emissions to the air and water as well as for the input of energy to the production process.

An analysis of the drivers behind reduced energy consumption shows that the change is due to improved product design as well as improvements in the individual components.

The analysis was divided into three phases: production, usage and disposal. For many parameters, disposal makes only limited contributions to the overall results. In most impact categories only around 25 per cent or significantly less results from solid waste disposal; the majority of the burdens stem from other processes for example the extraction of natural resources, manufacturing and transport.

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Used incontinence diapers are treated as part of municipal solid waste. They are compatible with prevailing waste treatment options and can be processed in existing waste management systems.

With the LCA method we have a tool not only for monitoring and communicating the continuous improvement of the product's environmental impact but also for identifying potential areas for improvement.

Integrated waste management

Waste is an inevitable product of society. Solid waste management practices were initially developed to address the adverse effects on public health of the ever growing amounts of solid waste being discarded without appropriate collection or disposal. Managing waste effectively becomes an increasingly important challenge to modern society. As a society we have to focus on producing less waste while at the same time ensuring we have an effective system for managing the waste that is produced.

There are four major considerations in developing sustainable waste management systems.
They need to:

1. Ensure human health and safety; they must be safe for workers and must safeguard public health by preventing the spread of disease;
2. Be environmentally effective; the waste management system must reduce as much as possible the environmental burdens of waste management (emissions to land, air and water, such as CO_2, CH_4, SO_x, NO_x, BOD, COD and heavy metals);
3. Be economically affordable; the waste management system must also operate at a cost acceptable to the community, which includes all private citizens, businesses and government;
4. Be socially acceptable; the waste management system must operate in a manner that is acceptable for the majority of people in the community. This is likely to require an extensive dialogue between municipal authorities and many different groups to inform and educate, develop trust and gain support.

Deciding the point of balance between environmental burden, cost and social acceptability will be a challenge and will inevitably generate debate; there will always be the need for trade-offs. What is certain, however, is that better decisions can be made if comprehensive data on environmental burdens and costs are available and are shared openly amongst the interested parties. Indeed, such data can often prompt ideas for further improvements.

In Europe the development of more sustainable waste management systems is characterised by the adoption of an integrated approach to waste management system design.
For the purposes of this report integrated waste management is defined as a system which includes:

- All types of solid waste materials; the alternative of focusing on specific materials, either because of their ready recyclability (e.g. aluminium) or their public profile (e.g. plastics) is likely to be less effective in both environmental and economic terms than taking a multi-material approach;
- All sources of solid waste; wastes such as domestic, commercial, industrial, institutional, construction and agricultural. Hazardous waste needs to be dealt with within the system, but in a separate stream. Focusing on the source of a material (on packaging or domestic waste or industrial waste) is likely to be less productive than focusing on the nature of the material, regardless of its source.

An integrated system needs to include an optimised waste collection system and efficient sorting, which is then followed by one or more of the options below in order to recover value as either materials, organics or energy prior to landfilling the residues:

- Materials recycling, which will require access to reprocessing facilities;
- Biological treatment of organic materials to produce marketable compost and to reduce volumes for disposal. Anaerobic digestion also produces methane that can be burned to generate energy;
- Thermal treatment such as incineration, which will reduce volume, render residues inert and should include energy recovery;
- Landfill, which will either increase amenity via land reclamation or will, through well-engineered sites, at least minimise pollution and loss of amenity.

An environmentally effective waste management system needs to contain all the treatment options listed above. At the present time landfill is the only method that can accept all types of waste since

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recycling, composting and thermal treatment all leave some residual material that needs to be landfilled; however, it recovers almost no value from the waste. Use of the other options is necessary prior to landfilling in order to divert the key recoverable parts of the waste stream. This approach will reduce the volume and improve the physical and chemical stability of the final residue. This will reduce both the space requirement and the environmental burdens of the landfill.

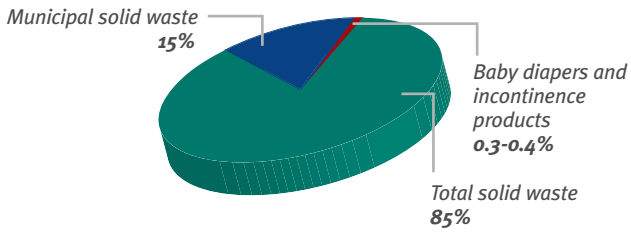
Diapers and incontinence products in municipal solid waste

Much of the discussion about baby diapers and the environment has focused on their contribution to solid waste. In those households where baby diapers are used, they naturally seem to represent a significant proportion of what goes into the bin. However, only one in 14 households on average will be using diapers at any one time.

Current estimates are that baby diapers make up about 2 per cent of municipal solid waste (MSW) in Europe. By comparison, paper and board, garden waste and food waste each comprise between 18 and 20 per cent of MSW. It is difficult to be precise about municipal solid waste data in Europe because of the different data sources available across the region. It is estimated, however, that municipal solid waste comprises around 8-15 per cent of all waste in Europe (depending on what is included in its definition).

Graph 16

Baby diaper and incontinence products waste contribution to MSW and to total waste in the European Union



Therefore waste from baby and incontinence diapers only comprises between 0.3 and 0.4 per cent of total solid waste.

→ Landfill

Landfill stands alone as the only waste disposal method that can accept all materials in the solid waste stream. It is also considered the simplest, and in many areas the cheapest disposal method and has historically been relied on for the majority of solid waste disposal. In several European countries (the UK, Ireland, Spain, Greece), the USA and virtually all developing countries, landfilling continues to be the principal waste disposal method. As land prices and environmental pressure increase,

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however, it is becoming more difficult to find suitable landfill sites, and so this position shows signs of changing.

The principal objective of landfilling is the safe long-term disposal of solid waste, from both a health and environmental viewpoint. Today, landfills in most industrialised countries, and increasingly in the developing world (as economic and social conditions allow), are constructed with environmental protection as a first priority. These landfills use clay or plastic liners where solid waste is added in a series of layers and covered with heavy soil, thereby preventing water from seeping through it and percolating into underground water supplies. Many sites today are designed to capture the methane gas (CH_4) which builds up inside and to use it as fuel.

Diapers and incontinence products behave like other forms of MSW and are readily compressed and contained in landfills. Tests conducted under a variety of conditions simulating landfills demonstrate that these materials do not present any public health or environmental safety risk (see References, Solid waste management and disposal p. 54).

→ Incineration (thermal treatment)

Thermal treatment of solid waste within an integrated waste management system can include at least three distinct processes: mass burn, refuse-derived fuel burn, and paper and plastic fuel burn. The most well known is mass-burning, or incineration, of mixed municipal solid waste (MSW) in large incinerator plants. There are two additional 'select-burn' processes whereby combustible fractions from the solid waste are burned as fuels. These fuels can be separated from mixed MSW either mechanically to form refuse-derived fuel (RDF), or can be source-separated materials from household collections such as paper and plastic, which have been recovered but not recycled. The incineration of solid waste can fulfil three distinct objectives:

1. Volume reduction; depending on its composition, incinerating MSW reduces the volume of solid waste to be disposed of by on average 90 per cent and its weight by 70-75 per cent. This has both environmental and economic advantages since there is less demand for final disposal to landfill, as well as reduced costs and environmental burdens from transportation if a distant landfill is used;
2. Stabilisation of waste; incinerator output (ash) is considerably more inert than incinerator input (MSW), mainly due to the oxidation of the organic component of the waste stream. This leads to reduced landfill management problems since it is the organic fraction that is responsible for landfill gas production and the organic compounds present in landfill leachate. Incinerator output can also be used for other purposes; for example the larger particulate ash is used to make hard core for road building;
3. Recovery of energy from waste (EfW); this represents a valorisation method, rather than just a pretreatment of waste prior to disposal. Energy recovered from burning waste is used to generate steam for use in on-site electricity generation or export to local factories and district heating schemes. Combined heat and power (CHP) plants increase the efficiency of energy recovery by producing electricity as well as utilising the residual heat. Often viewed as a 'renewable resource', burning solid waste can replace use of fossil fuels for energy generation. As a large part of the energy content of MSW comes from truly renewable resources (biomass), there should be a lower overall net carbon dioxide production than from burning fossil fuels, since carbon dioxide is absorbed in the initial growing phase of the biomass.

Diapers and incontinence products can be incinerated in all modern incinerators, including those designed for energy recovery. Relative to average municipal solid waste, they do not adversely affect safety or regulated emissions from waste to energy incineration processes, and are compatible with waste to energy operations and energy recovery systems in incinerator plants. Diapers and incontinence products consist of commonly used materials which can be safely incinerated under a variety of combustion conditions. They do not form unusual or uniquely toxic emission products. In fact, they can positively contribute to the effectiveness of thermal treatment because:

- The high quality of diaper materials positively affects the overall ash quality in terms of

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heavy metal load because of the low amounts of heavy metals compared to average municipal solid waste;

- The low ash content of diapers ensures a very high weight/volume reduction (approximately 90 per cent) during incineration. Ash production from diapers is less than 10 per cent by weight compared to 25 per cent or more for average municipal solid waste.

→ Biological treatment

Biological treatment can be used to treat both the organic and the non-recyclable paper fractions of solid waste. Biological treatment can be separated into two distinct processes – aerobic and anaerobic treatment – and therefore two main treatment types exist; composting (aerobic) and biogasification (anaerobic). Either can be used as a pretreatment to reduce the volume and stabilise material for disposal in landfills or as a way of producing valuable products from the waste stream such as compost and (from biogasification) biogas plus compost.

Biological treatment involves using naturally occurring micro-organisms to decompose the biodegradable components of waste. If left to go to completion, biological processes result in the production of gases (mainly carbon dioxide and water vapour from aerobic processes and carbon dioxide and methane from anaerobic processes) plus a mineralised residue. Normally the process is interrupted when the residue still contains organic material, though in a more stable form, comprising a compost-like material.

Almost any organic material can be treated biologically. It is particularly suitable for many industrial wastes from such sources as breweries, fruit and vegetable producers and processors, paper mills, sugar mills, and leather, wool and textile producers. Biological treatment is preferable to other treatments such as incineration and landfilling for wet organic material whose high water content and putrescible nature can cause problems. At the local community level, it is widely used to treat sewage sludge and organic waste from parks and gardens. It is estimated that some

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50-85 per cent (depending on geography) of MSW could be treated by such methods. Composting of biowaste and the non-recyclable paper fraction has been shown to have no negative effect on the composting process or compost quality.

Today's diaper and incontinence product raw material composition is compatible with composting provided there is appropriate technology available to separate the biodegradable, cellulose-based parts from the synthetic pieces. There are operations in Europe that accept diapers as part of the compostable household waste, in most cases. However, diapers and incontinence products are unsuitable for home composting.

→ Mechanical-biological treatment (MBT)

Mechanical-biological pretreatment is a hybrid technology. It is a combination of mechanical sorting and biological treatment, and sometimes a processing stage to convert the residual material into refuse-derived fuel (RDF).

The mechanical stage separates recyclables and rejects (batteries, tyres, etc.) to leave an organic fraction. The reject fraction can be incinerated or landfilled. The organic fraction is sent for treatment using composting or anaerobic digestion techniques. The remaining material is of low compost quality and is required to be incinerated or can be landfilled if it is biologically inert. This process significantly reduces the weight (through loss of moisture) and organic content of the output; this in turn results in significant reductions in both the material sent to landfill and in the methane production from landfills. Novel MBT plants offer new approaches to reduce energy requirements, increase value recovery and reduce environmental impacts of the system.

The MBT process is clearly able to accept used disposable diapers. The shredding process will effectively separate the various raw material fractions of the diaper. Further down the process the human waste and pulp will biodegrade. The remaining inert fraction (e.g., plastic material) will leave the MBT facility as biologically inactive residue that can be incinerated or landfilled with reduced volume.

→ Recycling

Material recycling is a valuable component of an integrated solid waste management strategy. It can help conserve resources, it can divert waste from final treatment and disposal and it involves the general public in waste management (e.g., cans, paper, bottles). Unlike reuse, recycling typically involves an industrial process which differs from the original process, primarily in that some of the virgin resources have been replaced by secondary ones.

In public perception, recycling is always presumed to be environmentally preferable. Recycling is a complex process, however, which itself consumes resources (to transport, sort, clean and reprocess) and generates waste. In addition, the collection method selected for recovering recyclables has a major influence on the overall costs of recycling as well as on the environmental impacts of recycling. The overall benefits (societal, economic and environmental) of recycling are hard to quantify; they depend on many varying parameters such as marketability of recyclables, separate collection infrastructure and technical effort.

While recycling as a waste treatment option might be technically conceivable for baby diapers and incontinence products, there is a high level of uncertainty about the marketability or reuse of the end products. The economic feasibility of recycling diapers and incontinence products would be constrained by the high costs of collecting the soiled products as an individual fraction of waste. In addition, the environmental benefits for separate recycling of a relatively small waste fraction such as baby diapers and incontinence products are questionable and would be disproportionately small in relation to the economic costs.

→ Industry playing its part to find solutions

The manufacturers of disposable baby diapers and incontinence products take their responsibilities for reducing waste very seriously. Individual member companies work hard to reduce the waste that is generated in their development and manufacturing processes as well as in the finished article itself. We recognise that we can also help to find new and innovative solutions for reducing waste in the community.

Through EDANA's membership of the Association for the Sustainable Use and Recovery of Resources in Europe (ASSURRE), an industry-led multi-sector association which promotes sustainable resource management, we are addressing

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the external challenges of external waste. We are currently involved in two projects:

- The Mechanical-Biological Treatment project is documenting the technological capabilities of this emerging waste treatment method to determine its waste minimisation potential and its compatibility with existing infra-structures. This study was completed and published in March 2005;
- The Sustainable Resource Management Through Sustainable Urban Management project is a case study of integrated waste management usage in leading cities in Europe in order to identify the key drivers that promote the development of sustainable resource management systems and to provide examples of what is possible at local, national and EU policy development levels. It commenced in 2004 and will run for 12-18 months.

Through involvement with projects like this we want to improve our understanding of waste issues and in partnership with others be part of the solution.

Environmental policies and instruments

Local authorities, national governments, the European Union and international organisations are all increasingly using environmental policies and instruments in order to pursue environmental objectives and to ensure that these objectives are integrated into other sectoral and economic policies. Such policies and instruments include:

- Taxes and tradable permits;
- The extension of producer responsibility to the post-consumer phase of a product;
- Green public purchasing programmes and initiatives;
- Voluntary approaches such as negotiated agreements, voluntary public programmes and unilateral commitments by firms.

We welcome opportunities to work with local authorities, national governments and the European Union to identify ways to improve the environmental efficiency and effectiveness of our products and activities. Our experience is that the most successful policies and procedures are developed in partnership with the relevant parties so that all of the implications and consequences can be considered upfront and policies developed accordingly.

There are some existing and proposed policy instruments

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(such as eco-labelling and financial incentives) which are cause for concern for our industry as it is our view that they operate to discourage innovation or do not meet their objectives when viewed in a broader context.

While EDANA fully supports the objectives of prevention and reduction of environmental burdens, we are concerned these eco-labelling schemes fail to inform the consumer fully about the environmental impact of products. Focusing only on one part of the life cycle of a product, they ignore the other very important dimension of efficient product use.

We would like to see more focus on the development of instruments which in our view have a larger potential for success. International standards would provide a way forward – they would provide better and greater opportunities for industry involvement in the development of the standards. This would result in the development of consistent and meaningful information being available to consumers. Environmental communication in line with product declarations (consistent with ISO 14025 Type III/ environmental declarations) could also be a possible way forward as could statements on packaging as prescribed either by laws or industry voluntary agreements.

"Innovation is the key to greater prosperity. To innovate is to sustain, so complacency is not an option. While innovators bear the upfront cost of action, society would bear the longer-term costs of inaction."

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5 | Prudent use of natural resources

Sustainable forest management

The use of wood pulp in baby diapers and incontinence products is a comparatively small part of total wood consumption. Paper products including newspaper, copy paper, household and hygiene paper consume about 15 per cent of the total, worldwide, commercial wood production. Only a very small amount, less than 1 per cent, is used globally for manufacturing disposable diapers, feminine care products and adult incontinence products.

Fluff pulp is the common name given to the cellulosic part of the absorbent cores in many absorbent hygiene products including diapers and incontinence products. There are many different grades of wood pulp derived from different species and processes. Hardwood is derived from species classed as Angiospermae (including eucalyptus and oak). Softwood is derived from species classed as Gymnospermae (including conifer and pine). While most paper making processes use both types of wood, fluff pulp uses only softwood fibres. This is because softwood contains coarse, bulky, long fibres which provide increased fluid retention and liquid distribution.

Most of the softwood used in baby diapers and incontinence products manufacture is grown in the northern hemisphere, mainly in North America and Europe. No wood from virgin tropical rainforests is used in the manufacture of absorbent hygiene products.

Sustainable production of timber is at the core of pulp production. Forests fix carbon in growing trees and well-managed forests actually result in a net increase in the standing volume of timber over unmanaged forests. Well-managed forests will typically address the following considerations:

- Biodiversity conservation;
- Sustainable production;
- Forest health and vitality;
- Soil and water quality;
- Global carbon cycles;
- Socio-economic benefits;
- Cultural heritage.

One of the mechanisms for ensuring forests are well managed is through third-party verification of forest management, including environmental and social considerations. We closely follow the development of different forest certification schemes both on an international and national level. There are several national, regional and international voluntary schemes including:

- The Forest Stewardship Council (FSC);
- The Pan European Forest Certification (PEFC);
- The Sustainable Forestry Initiative (SFI) in the United States;
- The Canadian Standards Association (CSA).

Members of EDANA are committed to supporting sustainable management of forests based on sound ecological science, social responsibility and economic viability. We encourage third-party verification or certification of compliance with sustainable forestry practices when it contributes to improvement in practices. We encourage development of standards, performance measures, and continual improvement in best practices for forest ecosystems. We recognise the benefits the methods employed by certification schemes bring to forest product companies since most schemes create a formal organisational framework for the

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setting of goals and operations as a whole. However, we do not specify certification by any single organisation.

Pulp production

Pulp production is a high-technology multi-stage process aimed at extracting the natural polymer cellulose from wood. Wood comprises:

- cellulose (40-55 per cent);
- hemi-cellulose (8-30 per cent);
- lignin (20-30 per cent);
- other compounds such as lipids, waxes, resins and proteins (1.5-5 per cent).

Bark is removed from the trees using a rotating mechanical debarker and the bark, together with recovered lignin, can be used to provide most (or even a surplus) of the energy for the mill or can be sold to a combined heat and power plant. The wood is then broken down into chips, which are put in to the pulping process. The lignin (a component of the cell wall), provides the strength and rigidity of the plants and needs to be removed from the pulp. This is achieved through a number of processes. The woodchips are 'cooked' in a digester with chemicals, which removes some of the lignin. The recovered lignin is either used for energy or processed and used for a variety of purposes such as road surfacing and animal feeds. The cooking chemicals are recovered and reused. In fact, many mills are largely self-sufficient in their energy requirements, reducing the environmental impact of their overall operations.

The pulp is then diluted and bleached, which removes the remaining lignin and creates the properties required for the end product. The elemental chlorine-free (ECF) method uses chlorine dioxide to remove lignin with no persistent, toxic and bio-accumulative compounds as by-products. Bleaching can also be performed using non-chlorine based compounds such as oxygen, hydrogen peroxide and/or ozone. This is called totally chlorine-free (TCF) bleaching. ECF and TCF produce pulps with different properties, but neither process is environmentally superior to the other. Waste products from both the ECF and TCF methods can be recycled, further reducing any environmental effects.

The resulting pulp can be used on site in the manufacture of final product or alternatively the water can be removed and the pulp formed into sheets or reels. This is then packaged and transported by lorry, ship or rail to customers for further use.

Some incontinence products use chemithermomechanical pulp (CTMP) instead of fluff pulp. In this process, woodchips are chemically treated and then heated and mechanically separated in a refiner. Altering the chemical concentrations and temperature means that the properties of the final product can be customised.

The baby diaper and incontinence products manufacturing process

There are three basic processes in the manufacture of diapers and incontinence products. They are:

- The fiberisation of the fluff pulp, addition of superabsorbent polymer and absorbent pad formation;
- Lamination with films, nonwoven substrates and elastic elements;
- Shaping, cutting, folding and packaging.

These three elements have remained the same over the past two decades even though the processes have changed dramatically with the introduction of new technologies. Major steps have been taken by manufacturers to increase production line efficiency and reduce manufacturing waste. In terms of raw material selection, each must be capable of being supplied with consistent quality to support high-speed manufacturing processes.

The technology required for product development and manufacturing is highly complex. There are a large number of specialist equipment and material manufacturers who work with the industry to drive process and product efficiencies. A major consideration in deciding on machinery, product and material design innovations is whether they have the capacity to consume less and use thinner, lighter materials. This contributes not only to a better product, but also to better environmental performance – a measure that the industry is committed to continue to improve.

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The manufacturing process itself produces little environmental impact. The fluff fiberisation and pad formation process generates heat, noise and some dust. Normal good manufacturing practice (often referred to as GMP) requires that these conditions should be controlled within the facility by soundproofing, ventilation, dust and fibre recycling and air filtration systems. There are no significant atmospheric or waterborne emissions caused as a result of normal operating conditions.

Lamination of substrates is primarily achieved by hot melt adhesives; thus avoiding the use of solvent-based adhesives and their associated environmental and physiological effects. Typical adhesive melting temperatures are generally in the 130-160 degrees centigrade range. Currently, lower melting point adhesives are being developed which may help reduce the energy consumption required to keep the glue molten.

Creating an anatomic shape in many hygiene products does create some offcut waste. However, with appropriate processes in place, this material can be reused or recycled as no contaminants are present. The remaining cut-off material that cannot be used is safely disposed of in line with existing and applicable regulations; for example, it can be used as refuse derived fuel.

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6 The economic contribution of the diaper and incontinence products industry

The market

Modern baby diapers are used for babies and young infants until toilet-trained. Usage averages at 3600-4250 units per child during the 'cuddling' period, up to 30 months, concentrated mainly in the first 18 months, but with the increasing use of pant diapers and training pants, extending into the child's toilet-training phase.

Adult incontinence products including fitted briefs, shields and pads, are used by men and women in cases of illness, temporary or permanent incapacity and handicap as well as effects of ageing.

The main difference between the markets served by these two products is that baby diapers are used for the first 2-3 years of the infant's life whereas adult use is generally long term.

Based on 2002 data, the population of Western Europe (EU-15, EEA and Switzerland) was around 391 million including 21 million infants from 0-4 years and 64 million adults over 65 years. The accession of new member states is estimated to have increased the total population by 100 million people. The number of children from 0-4 years in the European Union is expected to decline gradually from around 20.6 million in 2005 to 19.2 million by 2020. The European market comprises different countries forming a number of regional sub- markets. Overall the European market is about the same size as the US market. There are significant variations between countries in terms of market penetration of baby diapers and incontinence products. There is considerable growth potential, particularly amongst the newer member states.

In 2004 the annual volume of baby diaper products sold was estimated to be 20.25 billion units. This estimate includes taped diapers, training pants, pant diapers and inserts. Taped diapers represent over 95 per cent of the baby diaper market. The annual market value in 2004 was estimated to be between 4 and 5 billion euros.

Over the past 2 years the total European baby diaper market is estimated to have grown by 2.7 per cent. The four largest markets for baby diapers are Germany, the United Kingdom, France and Italy, which together represent 58 per cent of the current market. These are mature markets which, given the demographic trends mentioned above, are only growing slowly at around 1.3 per cent. The fastest-growing markets in Europe are the Czech Republic, Sweden, Turkey, Poland and Slovakia which, although currently representing only 13 per cent of the total market, between them have grown by 9 per cent over the past two years and are forecast to continue to grow in the coming years.

In 2004, the total estimated volume of incontinence products sold was 5 billion pieces which includes body-worn all-in-one products, (briefs or pants, mostly for severe incontinence), body-worn inserts (light, medium or severe incontinence) and under pads (bed or chair pads). The retail market is becoming an increasingly important market for these products and is growing at a much faster rate than the institutional market. In 2004 it was estimated that the value of the market for incontinence products in Europe, the Middle East and Africa to manufacturers was around 1.5 billion euros.

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Increased longevity and the ageing of the baby boomer generation in developed markets will continue to increase demand for age-related incontinence products. In addition, the significant transition in distribution from chemists and pharmacies where these products have been traditionally sold to increasingly growing mass market distribution, will further stimulate growth.

Employment

In total, the members of EDANA who manufacture baby diapers and incontinence products employ some 100,000 people in Europe; making a substantial contribution to the economic wellbeing of families and communities in the countries of Europe. In 2003/04, some 20,000 of those were directly employed in the manufacture of absorbent hygiene products in Europe. This is matched by a similar number upstream within raw material supplier industries, not to mention those employed downstream in logistics and commercial operations.

Members of the industry

EDANA/HAPCO members
Manufacturers of absorbent hygiene products

Accantia Health and Beauty	www.accantia.com
Arbora & Ausonia	www.arbora-ausonia.com
Arquest	www.arquest.com
Artsana	www.artsana.com
Fater	www.fater.it
Georgia-Pacific	www.gp.com
Hayat	www.hayat.com.tr
Hyga	www.hyga-int.de
Hygiene Oederan	www.hysalma.de
Johnson & Johnson	www.jnj.com
Kimberly-Clark	www.kimberly-clark.com
Laboratorios Indas	www.indas.es
Linette	www.linette.com
Ontex	www.ontex.be
Paper-Pak	www.paperpak.com
Paul Hartmann	www.hartmann-online.com
Procter & Gamble	www.pg.com – www.eu.pg.com
Rostam	www.rostam.co.il
S.I.L.C.	www.silc.it
Santex	www.santex.it
SCA Hygiene Products	www.sca.com
Tyco	www.tycohealthcare.fr

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7 | Summary

Through this report we have aimed to share information and data about how our industry addresses sustainable development. We have sought to extend the amount of information available within the public domain about our industry and its impact on social, environmental and economic aspects of life in modern society. We believe such openness and accountability can only serve for a better dialogue as it will help to better inform policy makers and company actions.

Baby diapers and incontinence products are an important element of modern-day life in Europe and will continue to be so for the foreseeable future. Our industry is vibrant and active, always seeking to bring increased benefits to the users of our products while at the same time striving to optimise the efficiency of our resource utilisation and to minimise the environmental impact of our processes and our products. We are proud of our achievements to date as well as being ever mindful of our responsibilities.

In baby diapers and incontinence products we produce products that fulfil an essential purpose in today's world. They:

- Enhance the quality of life of babies, parents, disabled people, older people and their carers;
- Have significant skin care benefits;
- Have an established safety profile so they can be used with confidence;
- Meet real consumer needs in today's world.

Our industry, although small in comparison to some others, is an important contributor to the European economy. We:

- Employ approximately 100,000 people and, specifically in the baby diapers and incontinence products sector, employ some 20,000 people;
- Have a network of suppliers and business partners researching and developing specialist equipment and materials, which in turn contributes to Europe's research capabilities and base of practical know-how;
- Invest in new technology and infrastructure in the newly emerging economies of Central and Eastern Europe;
- Generate revenues of some 6 billion euros each year.

We are aware of and active in fulfilling our social responsibilities. We:

- Have policies and procedures in place for managing corporate governance and compliance issues;
- Recognise and respond to societal concerns such as human rights, child labour, worker exploitation, diversity and equal opportunity issues;
- Believe in fair dealing and fair competition and abide by these principles wherever we operate;
- Listen to our consumers to ensure that we are addressing their concerns in the products that are brought to the market;
- Contribute actively to the communities in which we operate.

Our industry is a minor contributor to solid waste in comparison with other industries and activities. It represents between 0.3 and 0.4 per cent of total solid waste and around 2 per cent of municipal solid waste. By comparison, food and garden waste contribute approximately 10-20 times more to the European average municipal solid waste streams. Nevertheless, the industry accepts its environmental responsibilities and works hard to fulfil them.

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We have already made significant environmental advances:

- The average weight of a baby diaper has been reduced by around 40 per cent since 1987;
- We work with our suppliers to ensure good practice in sustainable forest management;
- We use life cycle assessment techniques to assess the environmental impact of our products and processes so that actions can be taken to improve environmental performance at all stages of the product process.

Product innovations resulted in significant environmental improvements:

- On air emissions, fossil-based CO_2 has decreased by 15 per cent and renewable-based CO_2 emissions decreased by 60 per cent since 1987. For NO_x a significant improvement was recorded in the order of 30 per cent and SO_x decreased by 15 per cent;
- On water emissions, important aggregated parameters such as chemical oxygen demand (COD) and absorbed halogenated organic compounds (AOX) decreased by 70 per cent;
- On four environmental impact categories we have achieved significant reductions since 1987; acidification and nutrification have significantly reduced by 20 per cent or more, global warming potential (greenhouse gas) and photochemical ozone creation potential (summer smog) have improved by around 15 per cent;
- We work with regulatory authorities to ensure that environmental standards are meaningful;
- We work with others, for example the Association for the Sustainable Use and Recovery of Resources in Europe, to help find new and innovative solutions to reducing waste in the community.

Diaper and incontinence products manufacturers know there is still much to do in order to pursue the goal of sustainable development. We are committed to playing our part. We will continue as an industry to push the boundaries of our environmental achievements because we recognise that by doing so we will not only work towards the important longer-term goal of 'not compromising the ability of future generations to meet their needs', but it will also help us to meet the needs of our current and future consumers.

In our individual company initiatives and through the work we undertake collectively as an industry we will continue to look to:

- Increase the efficiency of our use of natural resources;
- Reduce the amount of waste we produce;
- Reduce the amount of energy we use;
- Reduce our fossil-based CO_2 emissions.

We do not and cannot act alone. We need to work in partnership with governments at local, national and European levels as well as with consumer and environmental organisations and we welcome opportunities to do so.

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Appendix 1: Glossary

Absorbable halogenated organic (AOX): A standard measurement of organic halogens used for indication of the environmental effect of bleach plant effluents. Halogen refers to all the five elements fluorine, chlorine, bromine, iodine and astatine. In practice it is a measure of organically-bound chlorine.

Absorbent core: The central component of a diaper or incontinence product to which the fluid is transferred and in which it is then retained.

Absorbent hygiene products: Products designed to absorb bodily fluids through various stages of life. The market is segmented into three major areas: infant and child care, feminine care and adult care; the products include baby diapers, training pants, pant diapers, sanitary napkins, panty liners, tampons, incontinence briefs, inserts and pads.

Acidification: The process whereby air pollution – mainly ammonia, sulphur dioxide and nitrogen oxides – is converted into acid substances.

Acquisition/distribution layer (ADL): The component of a diaper or incontinence product through which the fluid is transferred and distributed within the absorbent core.

Anaerobic digestion: Anaerobic digestion is a biological process that produces a gas principally composed of methane (CH_4) and carbon dioxide (CO_2) otherwise known as biogas. These gases are produced from organic wastes such as livestock manure, food processing waste, etc. Anaerobic digestion reduces the odour and liquid waste disposal problems and produces a biogas fuel that can be used for process heating and/or electricity generation.

Backsheet: The layer of a diaper or incontinence product made of either polyethylene film or nonwoven film composite designed to prevent wetness transfer from the wearer to their bed or clothes.

Bio-burden: The number and nature of micro-organisms on a product.

Biogenic: Produced by living matter.

Biological oxygen demand (BOD): A standard measurement for the oxygen that wastewater or effluent will consume by the action of natural bacteria.

Breathable: Allows air circulation.

***Candida albicans*:** Yeast-like organism that can infect the mouth, the skin, the intestines or the vagina.

Cellulose wadding: A soft, thick (almost cloth-like) material made from paper.

Cellulose: One of many polymers found in nature. Wood, paper and cotton all contain cellulose which is a fibre made of repeating units of the monomer glucose.

Chemical oxygen demand (COD): A standard measurement for the equivalent oxygen amount that waste water or effluent will consume when oxidised chemically. The COD value is an estimation of the total amount of dissolved organic matter.

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Colony forming unit:	A measure of viable micro-organisms.
Coverstock:	The outer layer of a diaper or incontinence product that is in direct intimate contact with the user's skin. It allows instant transfer of the urine from the point of contact to the inside of the product. Sometimes also referred to as the topsheet.
Defibred wood pulp:	Wood pulp that has been put through a hammer mill to separate the fibres into 'fluff' which increases the bulk and, as a result, the absorbency of the pulp.
Diaper dermatitis:	An irritation of the skin covering the groin, lower stomach, upper thighs and buttocks.
Diaper:	Article worn by babies to absorb urine and contain faeces.
Dissolving grade wood pulp:	The technical name for fluff pulp.
EDANA:	The international association serving the nonwovens and related industries. It protects and actively promotes the common interests of nonwovens and absorbent hygiene product industries and their suppliers.
Elemental chlorine-free (ECF):	A bleaching process that substitutes chlorine dioxide for elemental chlorine in the bleaching process. Compared to elemental chlorine bleaching processes, ECF bleaching reduces the formation of many chlorinated organic compounds.
Etiological factors:	Scientific factors.
Fiberisation:	The separation of wood and other plant material into fibres or fibre bundles by mechanical (sometimes assisted by chemical) means.
Fluff pulp:	The common name for wood pulps used in the absorbent core of personal care products such as diapers, feminine absorbent pads and air laid absorbent products.
Global warming:	An increase in the average temperature of the earth's surface, which occurs following an increase in greenhouse gases.
Good manufacturing practices (GMPs):	Good manufacturing practices (GMPs) are guidelines that describe the methods, equipment, facilities and controls required for producing safe products. They require a quality approach to manufacturing, enabling companies to minimise or eliminate instances of contamination, mix-ups and errors.
HAPCO:	The Hygiene Absorbent Products Manufacturers Committee is run under the auspices of EDANA. It currently consists of 22 companies located throughout Europe who represent a dominant share of the production of disposable hygiene products: baby diapers, feminine care and absorbent incontinence products. The purpose of HAPCO is to present a clear understanding of absorbent hygiene products and the benefits they offer to society.

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Hot melt adhesives:	A solid thermoplastic adhesive that melts rapidly when heated and sets to a relatively low-strength bond when cooled. Unlike many other adhesives, hot melt adhesives do not set due to the evaporation of a solvent.
In vivo:	In a living organism, as opposed to in vitro (in the laboratory).
Lamination:	Bonding thin sheets together.
Life cycle assessment (LCA):	A technique for assessing the environmental aspects and potential impacts associated with a product throughout its entire life cycle, from raw material acquisition through production, use and disposal. An LCA consists of four steps: goal and scope definition, life cycle inventory (LCI), life cycle impact assessment (LCIA), and interpretation.
Life cycle impact assessment (LCIA):	See above.
Life cycle inventory (LCI):	See above.
Lignin:	A naturally occurring component of plants that helps provide strength in plants. Its presence in paper may contribute to chemical degradation of the paper, so it may be removed during paper manufacturing.
Lipases:	Enzymes which are active in the digestion of fats.
Nappy:	Term used for a diaper in the United Kingdom.
Natural resources:	Substances extracted by man from the earth. Examples are iron ore, crude oil, water and wood.
Nitrogenous:	Of or relating to or containing nitrogen.
Nonwoven fabrics:	Sheet or web structures bonded together by entangling fibres or filaments (and by perforating films) mechanically, thermally or chemically. They are flat, porous sheets that are made directly from separate fibres or from molten plastic or plastic film. They are not made by weaving or knitting and do not require converting the fibre to yarn. They are suitable for products that have limited life or are single-use, and have specific functions including absorbency, liquid repellence, resilience, stretch, softness and strength.
Nonwoven substrates:	See above.
Nutrification:	The process of phosphorus enrichment causing over-enrichment of lakes and rivers with nutrients, leading to excessive growth of algae and other aquatic plants.
Occlusion:	A term indicating that the state of something, which is normally open, is now totally closed.
pH:	A measure of the acidity or alkalinity of a fluid. The pH of any fluid is the measure of its range from 0 to 14 on a logarithmic scale, where 0 is most acid, 14 most alkaline and 7 is neutral.
Photochemical ozone creation potential:	The emissions of volatile organic compounds (VOCs) can produce ozone in the lower atmosphere by reaction with nitrogen oxides in the presence of sunlight. This photochemical reaction results in the formation of the

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	so-called 'summer smog'. Releases of VOCs to air can be compared on the basis of their potential to create ozone relative to ethylene.
Polyethylene film:	Thin plastic that comes in sheets of different thicknesses and sizes, rolled or folded.
Polypropylene:	A thermoplastic material similar to polyethylene but somewhat stiffer and with a higher softening point (temperature).
Proteases:	Enzymes which cause proteins to break into smaller pieces.
Raw materials:	Components of a product. Examples are fluff pulp, nonwoven fabrics and superabsorbent polymer.
Single-use product:	A product designed to be discarded after one use.
Superabsorbent polymers (SAP):	Granular crosslinked sodium polyacrylates used to absorb aqueous fluids, most commonly in baby diapers, adult incontinent products, feminine hygiene products and other products in the personal care markets.
Superinfections:	An infection following a previous infection, especially when caused by micro-organisms that have become resistant to the antibiotics used earlier.
Thermal treatment:	The treatment of waste in a device which uses elevated temperatures as the primary means to change the chemical, physical, or biological character or composition of the hazardous waste. Incineration is an example of thermal treatment.
Tissue wrap layer:	Used in some diaper products around the absorbent core structure or the storage layer. This serves to contain the dry structure during manufacture and assists in preventing distortion or collapse of the core when saturated with liquid.
Topsheet:	The outer layer of a diaper or incontinence product that is in direct intimate contact with the user's skin. It allows instant transfer of the urine from the point of contact to the inside of the product. Sometimes also referred to as the coverstock.
Totally chlorine free (TCF):	A virgin pulp bleaching process that uses oxygen-based compounds instead of chlorine-based compounds and chlorine derivatives.
Urea:	One of the chief waste products of the body. When the body breaks down food, it uses what it needs and eliminates the rest as waste. The kidneys flush the waste from the body in the form of urea, which is in the urine.
Valorisation:	The capture of energy from incineration.
Wet-strength tissue:	Tissue that has been modified by the addition of 'wet-strength resins' so that the tissue does not break up on contact with water.
Wood pulp:	Fibre from wood with varying degrees of purification that is used for the production of paper, paper board and chemical products.

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Copyright and publication details – published in 2005

About the publisher:
EDANA is the international association serving the nonwovens and related industries. **EDANA** exists to create the foundation for sustainable growth of the nonwovens and associated industries through active promotion, education and dialogue. It represents, protects and actively promotes the common interests of the nonwovens and absorbent hygiene product industries and their suppliers and provides the umbrella under which industry-wide initiatives of a non-competitive nature can be undertaken.

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ISBN 2-930159-52-9

D/2005/5705/2

Published by EDANA
International Association Serving
the Nonwovens and Related Industries
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B-1030 Brussels, Belgium
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Design: Alligence Communication Architects