

Aromatics Producers Association,
a sector group of CEFIC

AROMATICS

Improving the Quality of Your Life



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An introduction to Aromatics



Many items taken for granted in our modern, everyday lives rely on products made by the aromatics industry, with benefits like durability, comfort, lightweight design and safety. Aromatics are used to make products for areas such as medicine, transport, telecommunications, fashion and sports.

Key facts about aromatics

- Aromatics get their name from their distinctive aromatic or perfumed smell. The main substances in this group, benzene, toluene and the xylenes, are basic chemicals used as starting materials for a wide range of consumer products. Almost all aromatics come from crude oil, although small quantities are made from coal.
- Everyday items made with the help of aromatics can be found in the home, workplace and supermarket. They include a diverse range of products such as clothing, pharmaceuticals, cosmetics, computers, paints, vehicle components, cooking utensils, household fabrics, carpets and sports equipment.
- Products made using aromatics can reduce energy consumption and so have a positive impact on the environment. For example, lightweight plastic components in vehicles and aircraft, and insulating foams in houses and offices are made with the help of aromatics.
- Benzene has been attacked in the press as a hazardous product. It has indeed been classified as a human carcinogen by the International Agency for Research on Cancer (IARC). However it is important to note that benzene itself is not a consumer product. Benzene is used within the chemical industry to produce other chemicals; these are then used to make consumer goods. All handling and applications of benzene must meet strict international standards to protect the consumer from any risk. Industry generally applies even more stringent standards than are required by regulatory authorities.



The aromatics industry's socio-economic impact

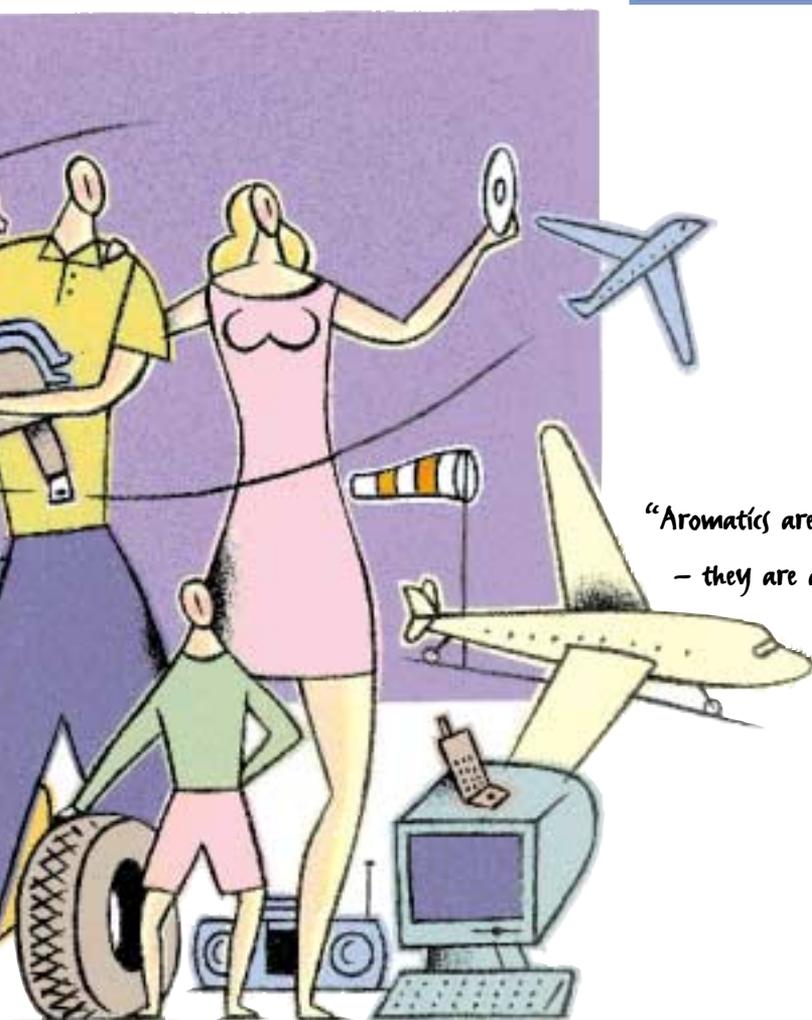
In 2000, European production of aromatics - benzenes, toluene and the xylenes – totalled 12.5 million tonnes with a value of EUR 4.6 billion. This sector has a major socio-economic impact in Europe, both in its contribution to Gross Domestic Product (GDP) in EU member states, in providing direct and indirect employment, and by producing raw materials for products that contribute to the comfort, safety and security of everyday life.

The aromatics industry directly employs around 20,000 people, and around 70,000 work in production of plastics and polymers, which are the principal derivatives of aromatics. The wider industry chain - including machine manufacturers and converters – is employing over 1 million people.

“Products made with aromatics, such as lightweight plastic components in cars and aircraft, help reduce energy consumption and so have a positive impact on the environment.”

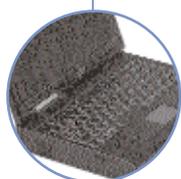
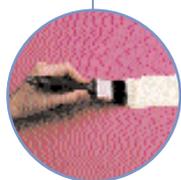
Insulation helps make homes more comfortable – keeping them warm in winter and cool in summer – and lowers utility bills. It also makes sense for the environment, reducing energy use and carbon dioxide (CO₂) emissions. It is estimated that since the energy crisis of the 1970s, the use of polystyrene foam insulation (produced from benzene) in construction has saved the equivalent of more than 23 billion litres of fuel oil world-wide. For typical households, it takes just one year to recover the energy needed to manufacture the insulating material.

Source: APME



“Aromatics are not only about everyday household products – they are also used in the manufacture of vital health care products, such as penicillin.”

Everyday products and aromatics

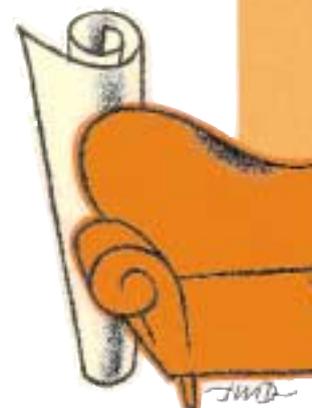


From benzene to food packaging, aspirin and nylon stockings

Benzene is a colourless liquid occurring naturally in fossil raw materials such as crude oil and coal. It is produced during processing of petroleum liquids and through chemical reactions. It is a key basic chemical for manufacture of a wide range of everyday items, and is not itself used directly by consumers. It is the major raw material for production of:

- Styrene, which is used to produce polystyrene and ABS (Acrylonitrile-Butadiene-Styrene) and rubber products. Polystyrene is found in the home, office, supermarket and fast-food restaurants. It comes in many shapes and forms, from foam egg cartons to disposable coffee cups, from CD "jewel boxes" to toys. "Peanuts" used in packing, and lightweight foam pieces which cushion new appliances such as televisions or computers, are also made with polystyrene. ABS is a tough plastic, widely used for computer and telephone housings, luggage, sporting helmets, automotive parts, and toys such as children's building bricks.
- Cumene and phenol are used as a starting material to make health-care products such as aspirin and penicillin, one of the first and still one of the most widely used antibiotic agents used to treat a wide variety of diseases, such as pneumonia, spinal meningitis, throat infections and diphtheria. Phenol is also used to produce bisphenol A, from which epoxy resins and polycarbonates are made. Epoxy resins are used to give high resistance to paints used on ships and in chemical storage tanks. Polycarbonates are transformed into compact discs, safety glass, safety helmets, lenses, light "plastic" glasses and cooling fans. Touch-sensitive panels on telephones are created with films of polycarbonate.
- Cyclohexane, used as an intermediate to produce nylon (see opposite), one of the earlier plastics and a versatile product with an endless list of applications. All consumers know its advantages when used in easy-care clothing, such as stockings, but its applications also include engineering plastics for cars, toys, health care products, carpets, roller-blade wheels, ship sails and parachutes, to name but a few.

Benzene is also used to produce vehicle tyres, detergents, solvents, dyes, cosmetics, aspirin and home care products.



Eradicating disease in the developing world

Nylon filter cloth is helping to further a US\$7.5 billion World Health Organisation effort to wipe out infectious diseases world-wide by 2030 by directly targeting one of them – Guinea worm disease (dracunculiasis). A special nylon monofilament cloth filters out Guinea worm larvae from drinking water and millions of square meters are now in use in Asia and Africa. As a result, Guinea worm disease is poised to become only the second disease in history of the world to be eradicated (smallpox was the first). The Carter Centre – initiated by former US President Jimmy Carter for administering the scheme – claims that the annual incidence of Guinea worm disease has been reduced by more than 95%. Fifteen years ago, it was estimated that more than 3.2 million cases of Guinea worm disease occurred and more than 100 million people were at risk of infection. Today, only about 150,000 cases remain in the world.

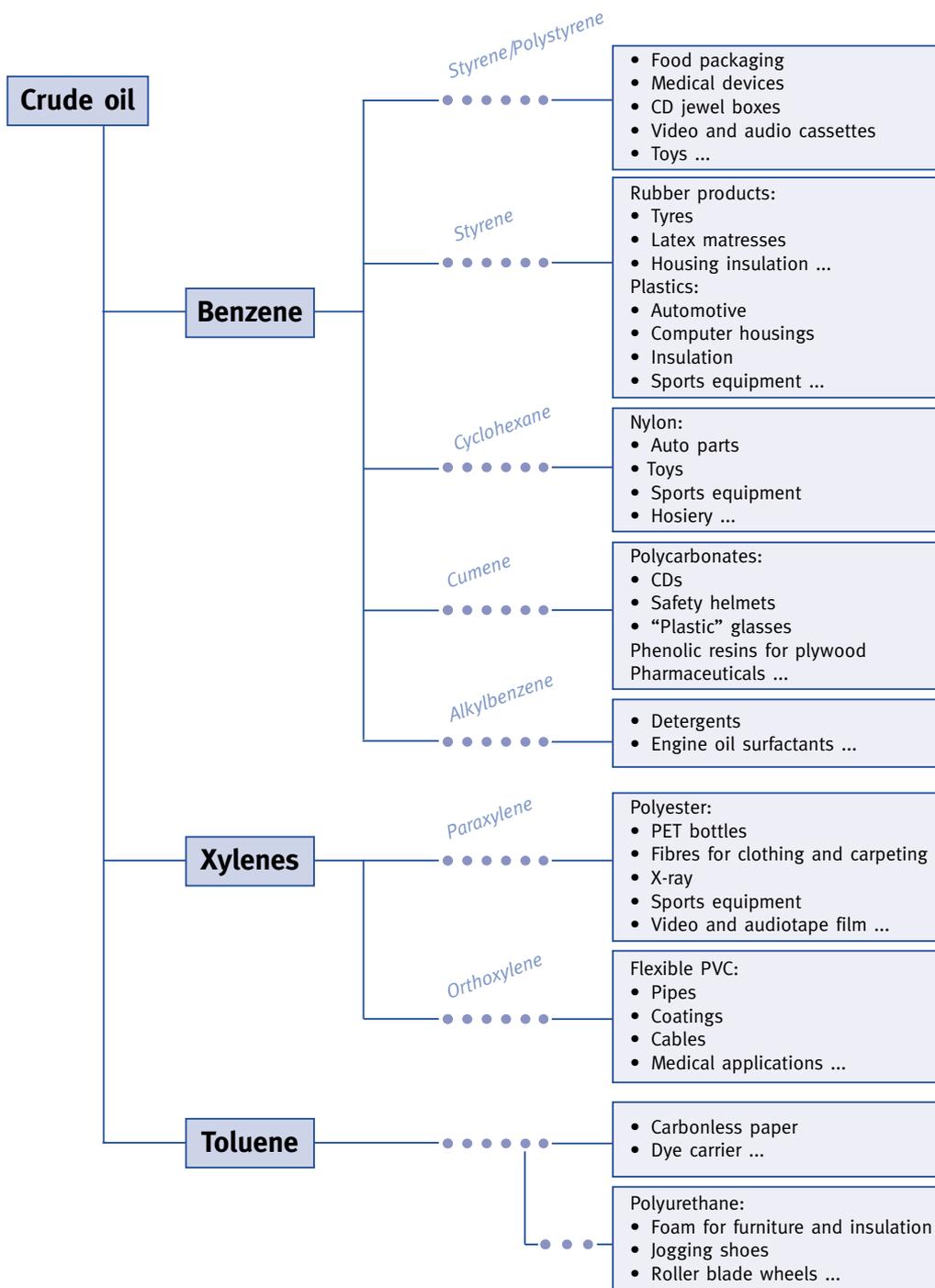
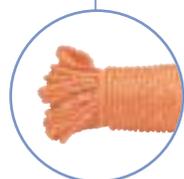
Source: APME



“Aromatics are also used to make fibres that can be varied to meet specific needs and produced in quantity. Resistant, warm, light, easy to wash, they can be used both in easy-care clothing and furnishing fabrics.”

“Aromatics contribute to making our lives easier around the working place: computer casings, touch-sensitive panels on telephones, compact discs and CD-ROMS, and resistant furniture are made using aromatics.”

Product flow: from aromatics to consumer products



From xylenes to anoraks and plastic bottles...

Xylene is a colourless liquid produced from crude oil or coal tar. There are several forms of xylene; of these, paraxylene is commercially the most important. Paraxylene is used to make polyesters, which have applications in clothing, packaging and plastic bottles. The most widely-used polyester is polyethylene terephthalate (PET), used in lightweight, recyclable soft drinks bottles, as fibres in clothing, as a filling for anoraks and duvets, in car tyre cords and conveyor belts. It can also be made into a film which is used in video and audio tapes and x-ray films.

Plastics packaging: advantages over conventional materials

In the past 50 years, innovations in plastics have revolutionised packaging and added value to the goods they protect and preserve. Thanks to the benefits of plastics in transportation, distributors and retailers around Europe are making substantial savings in resources, time and costs whilst reducing environmental impact. A lorry can carry about 80% more product and 80% less packaging when one-litre bottles made of glass are replaced by PET, which is produced with xylene – an important aromatic. This has a positive impact on the environment: thanks to the change from glass to plastic bottles, fuel consumption is reduced by up to 40% due to the need for fewer delivery trips.

Source: APME

From toluene to mattresses and ski suits...

Toluene is a colourless liquid, also produced from crude oil or coal tar. Its major end-products are polyurethanes, which are used to make the foam in furniture, mattresses, car seats, building insulation, coatings for floors and furniture and refrigerators. Polyurethanes are also used in artificial sports tracks, jogging shoes, and in roller blade wheels.



“Whether you’re jogging around the block or competing for the Olympics... Aromatics provide you with state-of-the art equipment.”

A responsible industry



All human activities have to be conducted following a number of common-sense rules in order to avoid taking unnecessary risks. Similarly, all chemicals have to be used for the purposes they are intended for, so as to protect the consumer and the environment from any unacceptable risk. The same goes for aromatics; they are safe for all their intended uses, but if they are not used or handled properly, they can have an adverse impact on the environment as well as on human health and safety.



Not only the aromatics industry but the whole chemical industry is committed to continuous improvement in all aspects of health, safety and environmental performance. This commitment is called Responsible Care and includes product stewardship, a way to monitor and minimise the potential adverse impact of products on human health and the environment. The industry gives the highest priority to the safety of its products with strict and detailed instructions for safe use, handling, transportation, processing and disposal.



Key factors in deciding whether chemicals could harm human health or the environment are **hazard** and **risk**.

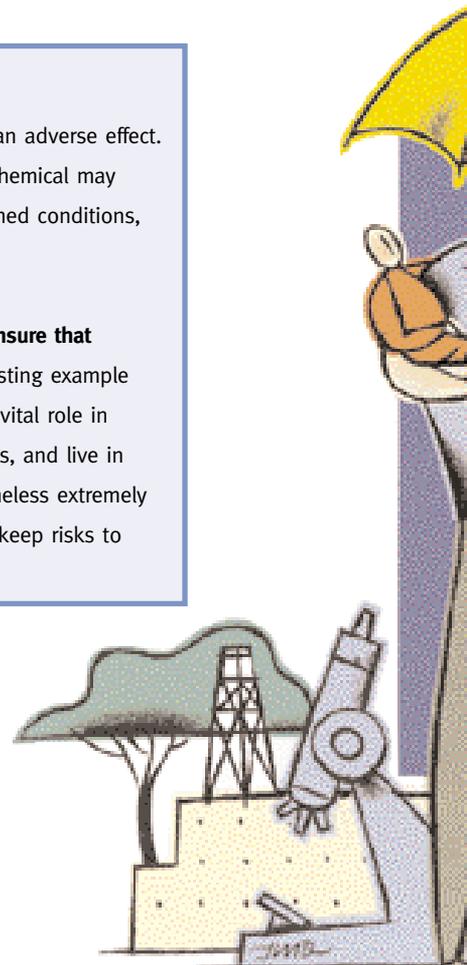
Hazard and risk

The **hazard** associated with a chemical is its intrinsic ability to cause an adverse effect. **Risk** is the chance that such effects will occur. For example, whilst a chemical may have hazardous properties, provided it is handled safely under contained conditions, any risk to human health or the environment is extremely low.

Almost all human activities involve some level of risk: the key is to ensure that the benefit outweighs the risk. The use of fire by humans is an interesting example of optimising the balance between hazard and risk. Fire has played a vital role in the evolution of our species, allowing us to eat a wider range of foods, and live in colder climates than would otherwise have been possible. It is nonetheless extremely hazardous and must be used under carefully controlled conditions to keep risks to a minimum.



Risk assessment takes into account the hazard posed by a chemical, a significant safety margin, plus any human or environmental exposure to that chemical. Risk assessments are being carried out at the European Union level to ensure that current usage of chemicals is not posing an unacceptable risk to human health or the environment.



Chemicals Management is part of the Responsible Care programme, and involves managing any risks related to chemical products during their whole lifetime, from design to disposal. This aims to achieve the best possible balance between acceptable risk and maximum benefit for society in the short-, medium- and long-term. Governments set the level of the balance in an open dialogue with stakeholders, including consumers and industry.

Human health and the environment

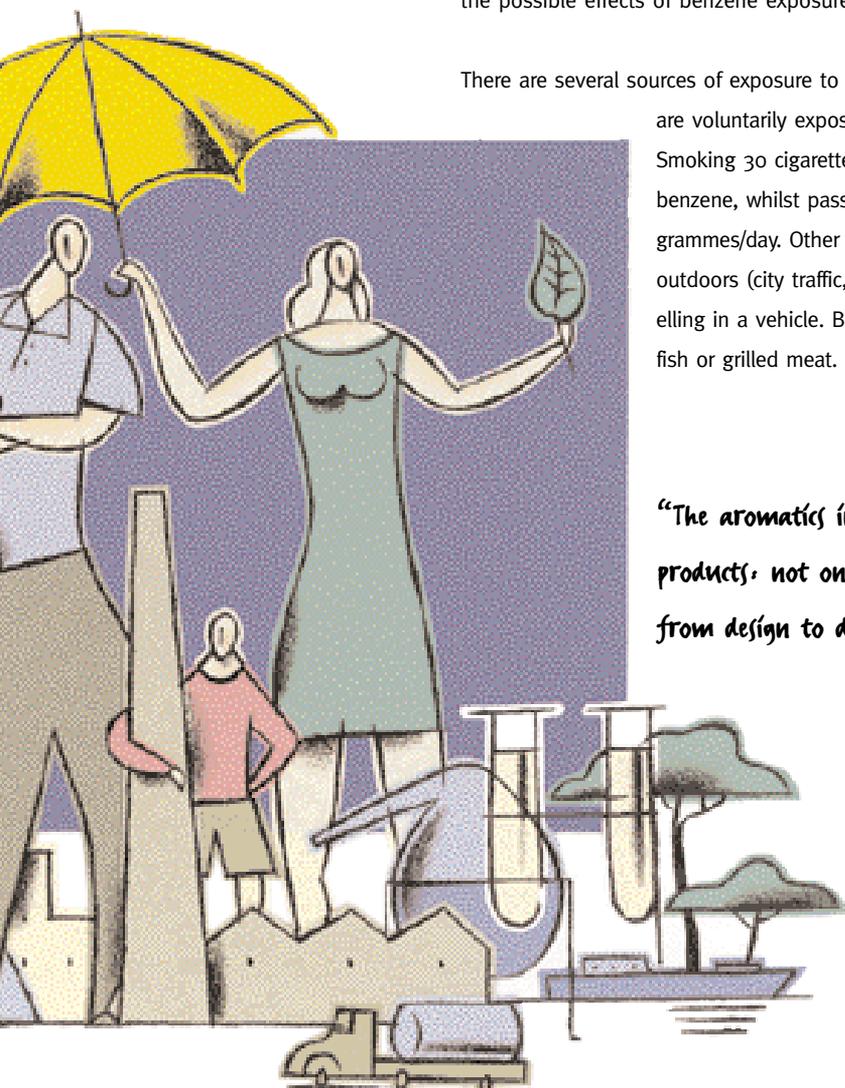
People working in the aromatics industry have developed a wide range of measures to ensure that consumers and workers are not exposed to harmful levels of aromatics during use or transportation.

Risks of exposure during transportation – which takes place mainly via the sea or inland waterways – are controlled by international guidelines on safe handling of cargoes. Some 1.2 billion tonnes of chemicals are moved annually in Europe, accounting for 8% of all freight transported, and costing some EUR 40 billion/year – a high level of costs which confirms industry's commitment to moving chemicals safely.

Of the three main groups of aromatics, most concerns have centred around the product benzene. For this reason, scientists in several regions of the world have studied the possible effects of benzene exposure both to consumers and in the workplace.

There are several sources of exposure to benzene for the general public. Many people are voluntarily exposed to benzene when they smoke cigarettes. Smoking 30 cigarettes produces about 1800 microgrammes of benzene, whilst passive smoking contributes about 50 microgrammes/day. Other sources include ambient air, both indoors and outdoors (city traffic, open fires and stoves), car refuelling and travelling in a vehicle. Benzene is also found naturally in foods such as fish or grilled meat.

“The aromatics industry is committed to managing any risks relating to its products, not only in the production phase but during their whole lifetime, from design to disposal.”



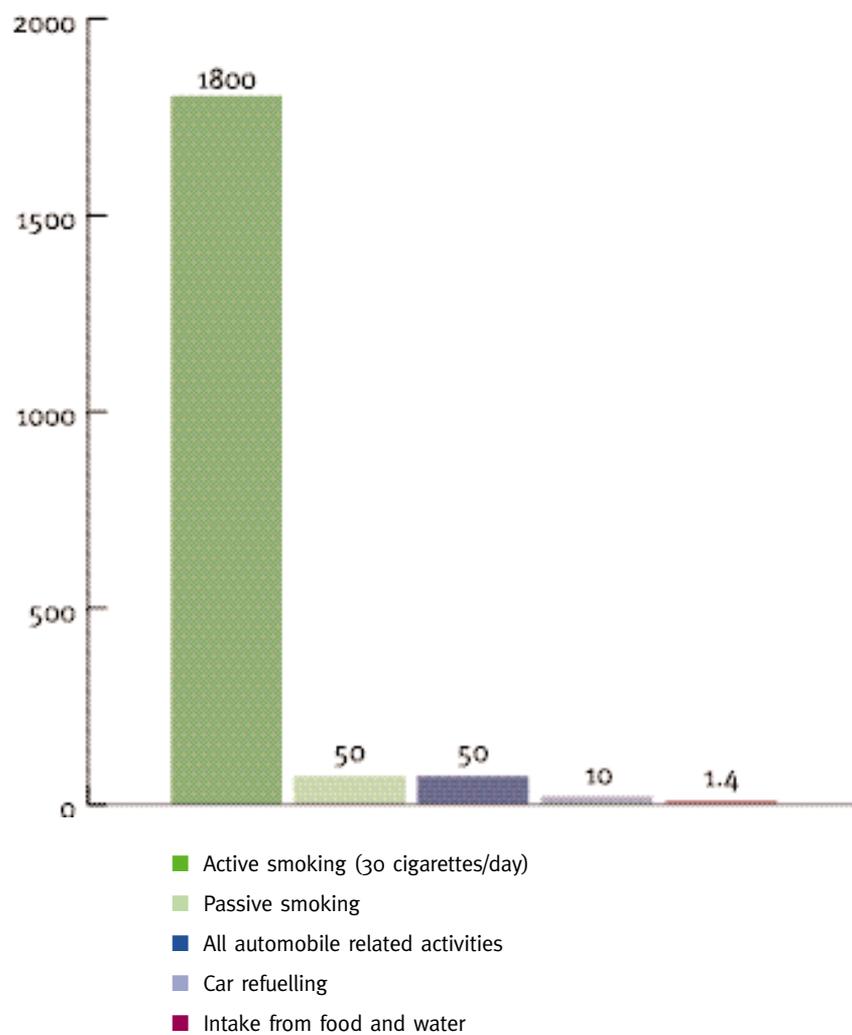


From the table below, it will be seen that the overall daily dose of benzene for any individual is unique, since it depends on life-style. In rural areas, exposure is far lower than in cities. US studies have shown that the contributions to overall benzene intake from chemical manufacturing, drinking water, food, beverages and crude oil refining are minimal.



Sources of benzene exposure to general public

(in microgrammes)



Based on figures issued by World Health Organisation, International Programme on Chemical Safety, Environmental Health Criteria 150. Benzene. 1993. Data based on Canada and USA.



“The general public is usually not exposed to benzene, except for extremely minute amounts from a variety of sources, such as city traffic, open fires, smoking and car refuelling.”

Benzene emissions

Although it remains impossible to totally eliminate benzene emissions from factories which make and use this chemical, the quantity of benzene emitted into the air is negligible, and represents less than 6% of all benzene emissions. Besides, the level of benzene emissions has been reduced by 50% since 1995, and the aromatics industry remains committed to further reducing these emissions using methods such as strict air monitoring programmes at production sites, nitrogen blanketing of storage tanks, and installation of vapour recovery systems.

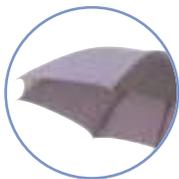
The substantial improvements made by industry in recent years have contributed to significant reductions in emissions of benzene into water from production plants. This factor, together with the increased efficiency of the wastewater treatment units, has led to a drastic reduction of benzene emissions in effluents.

In addition, tests carried out following the OECD testing methods have confirmed the biodegradability of benzene.

In the workplace

Workers' health and benzene levels in air are monitored at production sites. Air monitoring is a legal requirement for chemicals such as benzene, which have an occupational exposure limit. This is the legal maximum air concentration permissible in the workplace that regulators have reason to assume does not cause health effects in workers over a working lifetime daily exposure. National and international standards exist which limit this exposure by imposing strict occupational exposure limits; the European Commission imposes a limit of 1 ppm (1 part per million, in milligrams benzene per cubic meter air) in the workplace. To illustrate what is meant by 1 ppm, one should imagine a fifth of a drop of water in a 10-liter bucket of water. Industry standards are usually more stringent than this, and often include occupational monitoring programmes to confirm that workplace controls and practices are as safe as possible.

“The level of benzene emissions from factories represents less than 6% of all benzene emissions. These have been reduced by 50% since 1995, and the industry remains committed to reducing them even further.”



In conclusion...

Benzene is an essential starting material for the manufacture of a very wide range of consumer products. It has often been attacked as a hazardous product; long-term exposure to high levels of benzene vapour has indeed been associated with serious health risks. However, present working conditions drastically reduce such a risk for production plant workers; and consumer products contain only trace amounts of benzene, as all benzene made by industry is used to produce other chemicals which are then used to make consumers goods. These must in turn meet strict international standards to protect the consumer from any risk.

The general public is commonly not exposed to benzene, except for extremely minute amounts from a variety of sources, such as city traffic, open fires and smoking, both active and passive, car refuelling and travelling in a vehicle. Therefore, the overall exposure of an individual to benzene can be said to be unique to that individual, since it is dependent on his/her life-style and daily activities. In rural areas, for example, exposures are far lower than those found in the cities.

Men and women working in the aromatics industry take their responsibilities seriously; they, and their families, are consumers themselves, and they strive for a continuous improvement of their health, safety and environment-related performance.

This is why they are more demanding with themselves and continuously develop new technologies that will allow them to apply more stringent standards than are required by regulatory authorities.

The aromatics industry is an innovative and a strictly regulated sector, constantly developing new products that contribute to our quality of life while at the same time respecting and protecting the consumers' general interests.

The Aromatics Producers Association

The Aromatics Producers Association (APA) is a sector group of the European Chemical Industry Council (CEPIC). APA represents European producers of aromatics, and is committed to developing a co-ordinated approach to health, safety, environment, distribution and technical issues, whilst promoting the competitiveness of the industry.

The Association also conducts work in the technical, toxicological and environmental areas to ensure that European and international regulations on classification and exposure limits for aromatics are based on sound science.

Membership

APA comprises the European producers of aromatics:

ARAL
Atofina
BASF
Bayer
Borealis Polymers
BP Chemicals
CEPSA
Conoco
DEA Mineraloel
Dow Europe
DSM Hydrocarbons
EniChem
ExxonMobil Chemical Europe
Huntsman Petrochemicals
OMV Deutschland
Petroleos de Portugal (Petrogal)
Shell Chemicals
Veba Oil Refining and Petrochemicals

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Disclaimer

This document is intended to provide information to those wishing to know more about aromatics. It has been drawn up according to APA best knowledge of this subject matter and is designed to be as accurate and useful as possible. By necessity, the authors disclaim their liability with regard to misinterpretations or misuses of the information contained in it.

Photocredits

Courtesy of BASF, BP Chemicals, EniChem, Shell



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