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EA - South West/99-11
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INDUSTRY IN AVONMOUTH



*A public guide to
pollution management*



ENVIRONMENT
AGENCY

THE ENVIRONMENT AGENCY - WHO WE ARE

As 'Guardians of the Environment' the Environment Agency has legal duties to protect and improve the environment throughout England and Wales and so contribute towards 'sustainable development' - meeting the needs of today without harming future generations.

The Agency was created by the 1995 Environment Act and started work in April 1996. We have eight regions split into 26 areas. This report has been produced by the North Wessex Area which has its office at Rivers House, East Quay, Bridgwater TA6 4YS.

The vision of the Agency is:

A better environment in England and Wales for present and future generations.

Environmental themes

The Agency's principal and immediate environmental concerns relate to:

-  Addressing the causes and effects of climate change
-  Regulating major industries effectively
-  Managing waste
-  Conserving the land
-  Improving air quality
-  Managing water resources
-  Delivering integrated river-basin management
-  Enhancing biodiversity
-  Managing freshwater fisheries

Our work includes issuing authorisations, carrying out inspection and monitoring and, where necessary, taking enforcement action.

Authorisations

We issue several different types of permit to allow people to:

- operate large, technically complex and potentially polluting industrial processes ('Integrated Pollution Control' authorisations);
- put effluent into a watercourse ('discharge consent');
- handle or tip waste on the land (various 'waste management licences').

Inspection and monitoring

The Agency inspects and monitors the environment regularly. We also regulate the licences and consents that we issue. We check to make sure that the standards we have set are being met.

Enforcement

The Agency has to make sure that the law is followed and that we take action when someone doesn't follow the rules. When necessary, the Agency will prosecute offenders for the problems they cause. We run a 24-hour service monitoring pollution and other environmental incidents. Our 24-hour Emergency Hotline number for reporting environmental incidents is **0800 80 70 60**.



EA - South West / 99-46

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ENVIRONMENT AGENCY

NATIONAL LIBRARY &
INFORMATION SERVICE

SOUTH WEST REGION

Manley House, Kestrel Way,
Exeter EX2 7LQ

GLOSSARY

1995 Act – Environment Act 1995**1990 Act** – Environmental Protection Act 1990**Abatement** – Reduction**Acid rain** – Cloudwater, rain and snow that are made more acidic than normal by emissions of sulphur and nitrogen compounds from the combustion of fossil fuels**Authorisation** – A legally enforceable document, issued under the Environmental Protection Act 1990 Part 1, giving permission to operate a process within certain defined conditions**BATNEEC** – Best Available Techniques Not Entailing Excessive Cost**Biocide** – A water treatment chemical for removing living materials from water supplies**BPEO** – Best Practicable Environmental Option**Biodiversity** – The number of different plant and animal species, including variants within each species, in a ecosystem. The variety of life**Catalyst** – A substance that aids or speeds up a chemical reaction while remaining unchanged itself**CIMAH** – Control of Industrial Major Accident Hazards Regulations**COMAH** – Control of Major Accident Hazards Regulations**Deregulation** – Freeing from regulations or controls**Directive** – Legislation issued by the European Community which requires a member state to implement its requirements, for example to achieve specified environmental standards**Discharge consent** – A statutory document issued by the Environment Agency which defines the legal limits and conditions on the discharge quality and volume of effluent to a watercourse**Effluent** – Liquid waste from industrial, agricultural or sewage plant**Emissions** – Direct discharges of pollutant from a process into the environment**Enforcement action** – Action taken by the Agency if a licence holder contravenes the terms of their consent**Feedstock** – Raw materials input to a chemical process**Fungicide** – Fungus-destroying substance**Global warming** – The increase in global temperatures caused by artificial emissions of certain gases which increase the atmosphere's retention of energy from the sun**HSE** – Health and Safety Executive**IPC** – Integrated Pollution Control, a system introduced to control pollution from industrial processes which could cause significant pollution to air, land and water**IPPC** – The IPPC Directive is designed to prevent, reduce and eliminate pollution at source through the prudent use of natural resources**ISR** – Inventory of Substances and Releases**Landfill site** – Site used for waste disposal into/onto land**Local authority** – The body of people given responsibility for administration in local government**National grid** – A network of high-voltage electric power lines between major power stations**NTS** – National Transmission System, the natural gas pipeline network for the UK**Particulates** – Fine particles suspended in a gas or liquid**Pharmaceuticals** – Medicinal drugs**Prill** – Small solid particles formed by the evaporation of concentrated droplets of a solution**Quench towers** – Plant used for cooling a hot gas stream**River basin** – Whole area which drains naturally or with artificial assistance to a river**Scrubbing** – Gas cleaning by contact with falling liquids or powders**Smelting** – Heating and melting ore so as to obtain the metal it contains**Surface water** – Water which flows or is stored on the ground surface**VOC** – Volatile organic compound. A wide range of hydrocarbon and organic substances which vaporise readily at normal temperatures and pressures**Watercourse** – Stream, brook or artificial waterway.

ENVIRONMENT AGENCY



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A public guide to
pollution management

INTRODUCTION

For more than 70 years Avonmouth has been a centre for major industries. It employs a large number of people in a wide range of processes, from making pharmaceuticals to smelting zinc.

The industries make vital products such as anaesthetics and agricultural fertilizers and provide important services such as gas storage. They also make a big contribution to the local and national economy.

As part of their manufacturing processes, the industries release substances to air, land and water. Emissions are discharged into the air, waste is put into landfill sites and effluent goes into the sewer system or watercourses.

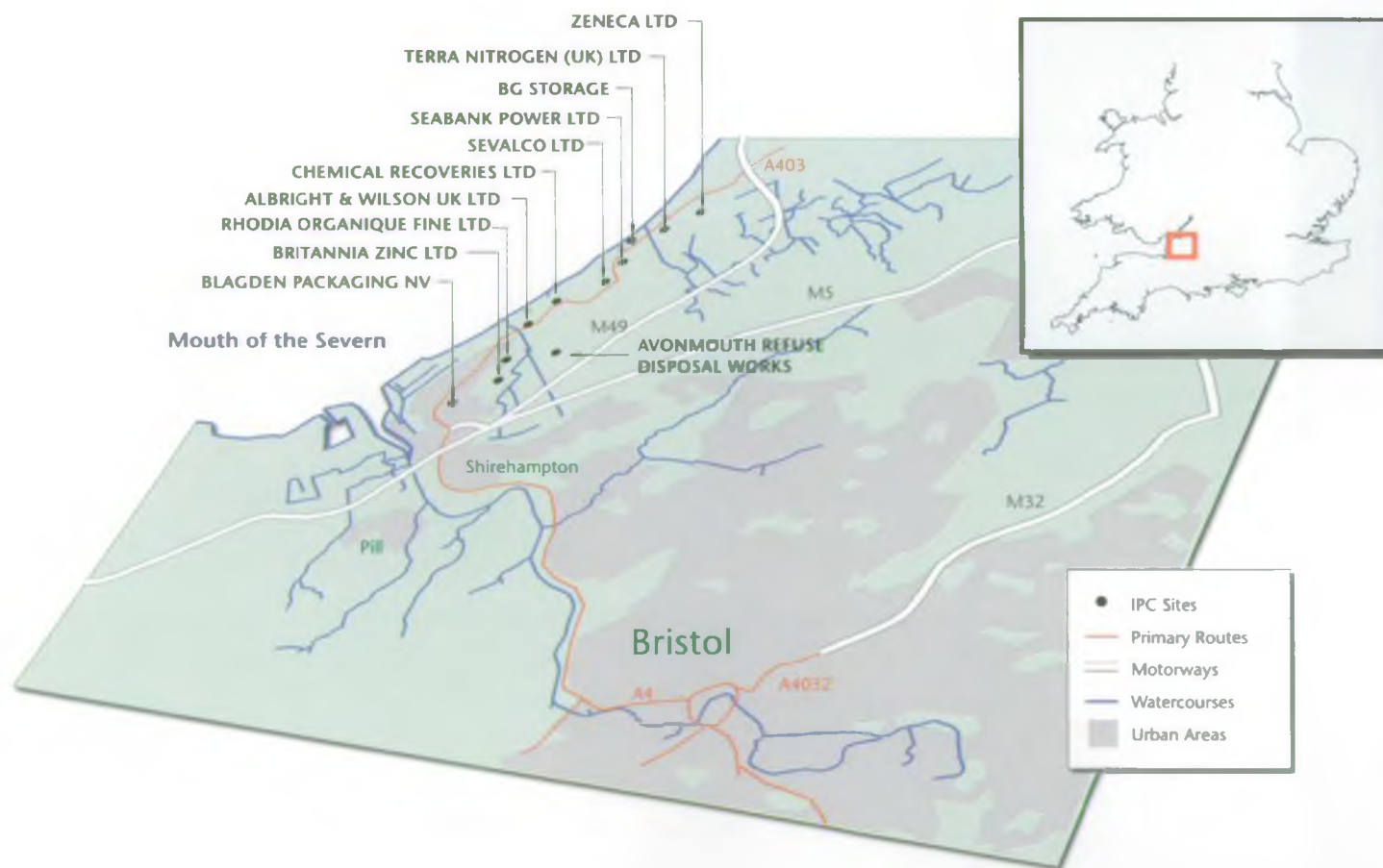
The job of the Environment Agency at Avonmouth is to regulate industry to ensure this pollution is prevented or minimised so that the environment is protected and enhanced.

The local authorities covering the area - Bristol City Council and South Gloucestershire Council - also have a role in regulating industry.

This guide looks at:

- the individual processes carried out by 10 major operators in the Avonmouth area;
- how the processes are regulated and what the operators are doing to improve their environmental performance;
- the benefits of the processes and how well they have performed for the environment;
- the operators' plans for dealing with any emergencies that may arise.

At the end of the guide are details of how you can find out more about the Environment Agency and our work at Avonmouth.



HOW THE ENVIRONMENT IS MANAGED AT AVONMOUTH

The 10 sites at Avonmouth included in this report are regulated under the Environmental Protection Act 1990. This Act introduced Integrated Pollution Control (IPC) for releases to air, land and water.

Under IPC, the Environment Agency regulates 2,000 of the potentially most polluting and technically complex industrial and other processes in England and Wales - the 'process industries'.

The process industries are potential contributors to global environmental effects such as acid rain and global warming, as well as a wide variety of more local environmental problems. Process industries can do serious harm to water, air and land quality. The natural and man-made environment, fauna and flora need conserving and protecting against pollution.

The Agency's aim is to help prevent pollution, and to minimise or make harmless releases to the air, on land or to water. We do this by regulating the process industries under IPC.

Integrated Pollution Control

Before it can carry out a process which could create pollution, a company must apply to the Agency for an 'authorisation' or licence under the Environmental Protection Act 1990.

When it receives an IPC application the Agency consults a number of organisations, including the Health and Safety Executive (HSE), the local authorities and English Nature. The applicant is required to advertise the application in local newspapers and invite the public to send any comments to the Agency. We take all these views into account before we make a decision on the application. For particularly sensitive or controversial decisions we would consult even more widely and may hold public meetings.

IPC requires operators to assess all aspects of a process, including its design, operation and impact on the environment as a whole.



Under IPC, operators have to:

- use the Best Available Techniques Not Entailing Excessive Cost (BATNEEC) to prevent or minimise polluting substances and make harmless all released substances;
- apply the BATNEEC principle for minimising pollution to the environment as a whole, having regard to the Best Practicable Environmental Option (BPEO) for the releases;
- place on a public register details of the processes and data on the releases produced;
- get prior approval before operating a new or substantially changed process.

From November 1999, IPC will be progressively replaced by regulation under the new Integrated Pollution Prevention and Control (IPPC) regime. This is based on the success of IPC and will include all of the sites mentioned in this guide, plus some additional ones, for example major waste treatment/disposal sites and sewage treatment works. It will also bring in regulation of noise, energy efficiency and raw material use.

HOW THE ENVIRONMENT IS MANAGED AT AVONMOUTH

All the operators mentioned in this report are authorised to operate in compliance with the Environmental Protection Act 1990 under authorisations issued by the Agency. Their authorisations require them to carry out improvements in environmental performance.

The emissions to air and discharges to water and land from the processes must be monitored regularly and reported to the Agency. The Agency itself regularly carries out spot checks on emissions and discharges at the sites.

The results of the monitoring are available for public inspection at the offices of the Environment Agency, Bristol City Council (for operators in the City Council area) or South Gloucestershire Council (for operators in South Gloucestershire) - see the section on How to Get More Information.

The role of local authorities

The local authorities covering the Avonmouth area - Bristol City Council and South Gloucestershire Council - have an important role in regulating industry.

The councils are invited to comment on applications to the Environment Agency for 'Part A' authorisations under the 1990 Act. The operators mentioned in this report all have Part A authorisations. Three of them - Terra Nitrogen, Zeneca and BG Storage - are in the South Gloucestershire Council area. The other seven are in the Bristol City Council area.

'Part A' authorisations are for processes that are potentially more polluting and more technically complex than 'Part B' authorisations, which are issued by local authorities and only regulate emissions to air.

The local authorities are also responsible for noise control. When there is a complaint about excessive noise from industry, their officers investigate. Where appropriate the officers take enforcement action requiring the operator to reduce the noise.

Planning applications for new industrial sites or expansion of existing sites are decided by the local authorities. They consult the Agency and other organisations before making their decision.

Emergency plans

All the operators in this report have prepared plans to deal with a fire or other emergency on their sites. These 'on-site emergency plans' are designed to safeguard lives and protect property.

They have worked closely with the local authorities and the fire, police and ambulance services in drawing up their on-site emergency plans. They also carry out exercises - sometimes with the emergency services - to test their plans.

The local authorities draw up 'off-site emergency plans' for co-ordinating responses in case an incident's effects go beyond the boundaries of a site. The HSE enforces the provision of both on-site and off-site emergency plans.

The Control of Industrial Major Accident Hazards (CIMAH) Regulations apply to some of the sites. These regulations, administered by the HSE, aim to prevent major industrial accidents. They also aim to limit the consequences to people and the environment of any accidents that do occur.

The CIMAH Regulations are being superseded by the Control of Major Accident Hazards (COMAH) Regulations. The changeover period began in April 1999 and will take approximately three years to complete. These new regulations will also require consideration of the effect of major accidents on the environment and will be enforced jointly by the HSE and the Environment Agency. Most of the sites in this report will eventually be subject to the COMAH Regulations.

ALBRIGHT & WILSON UK LTD

■ Introduction

International chemicals manufacturer Albright & Wilson has a 14-acre site at Avonmouth employing more than 100 people. The site produces organic speciality chemicals and operates 24 hours a day, seven days a week and 52 weeks a year.

■ What is the process?

About 20,000 tonnes of flame-retardant products and 5,000 tonnes of water management chemicals are produced by the factory annually.

The flame retardants are used in making fire-resistant polyurethane foam for packaging, insulation, car components and furniture. They are based on phosphorus chemicals produced by the company and also need alcohol and epoxide chemicals.

The water management chemicals are biocides and fungicides which are made from chemicals produced on the site. They are used in the processing or manufacture of leather, timber, adhesives, paper and paint. Other uses are in oilfields and industrial water treatment.

■ How is it regulated?

Albright & Wilson has five authorisations to operate processes under the Environmental Protection Act 1990. In granting these authorisations, the Environment Agency assured itself that the site was using the Best Available Techniques Not Entailing Excessive Cost (BATNEEC). These techniques prevent or minimise releases of substances and make harmless any substances which are released or may cause harm.

The Control of Major Accident Hazards (COMAH) Regulations apply to the site. These aim to prevent major chemical industrial accidents. They also aim to limit the consequences to people and the environment of any accidents that do occur. A detailed health, safety and environment risk assessment has been completed. It describes how the company has reduced risks as far as is reasonably practicable.

**■ What are the benefits?**

Albright & Wilson is committed to the Chemical Industries Association's Responsible Care programme. This programme is designed to help improve the chemical industry's performance and to enable companies to demonstrate that improvement to the public. It is an important step in meeting growing concerns about the health, safety and environment aspects of the industry.

The company is also committed to operating its factories worldwide to the highest health, safety and environment standards using the latest techniques. These include all aspects of management systems, training, design and maintenance.

In 1996, 20 per cent of capital spending for the site was on projects to improve environmental protection.

More than 90 per cent of the products are exported, earning substantial foreign revenue for the British economy.



ALBRIGHT & WILSON UK LTD
■ What are the site's emergency plans?

In the event of a major emergency on the site such as a fire or gas release, the response will follow pre-arranged procedures designed to safeguard lives and protect property. A major emergency is an uncontrolled event needing - or appearing likely to need - resources beyond those immediately available on the site.

The emergency services and local authorities have been involved in producing a plan to cope with major incidents. The company has also developed an on-site plan to cope with emergencies. Key people in the emergency response team will take control of the situation.

■ How well has the process performed for the environment?

To comply with Integrated Pollution Control, the company's philosophy has been to focus on improvements to the processes such as the chemistry, design and management. It will

only resort to end-of-the-pipe solutions - dealing with emissions to air or water after they have been produced - if there is no practicable alternative.

Albright & Wilson continues to improve the processes to eliminate wastes or reduce them to a minimum. Where possible it has sought to develop new techniques to reduce or eliminate discharges of the most harmful substances.

The company has been working to an improvement timetable agreed with the Agency. It has tackled the highest priority projects first. Priority depends on the annual total of the substance released, an assessment of environmental and health risks.

The site performance since 1994, when the company first regularly monitored its releases, is shown in the charts opposite.



ALBRIGHT & WILSON UK LTD

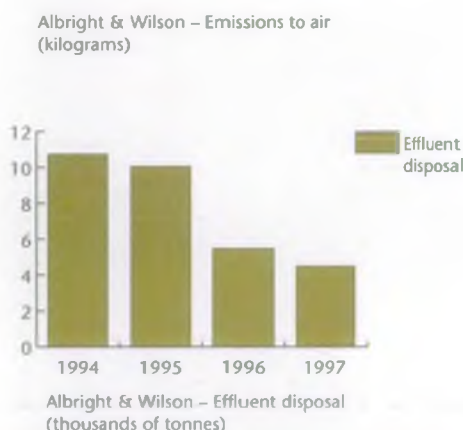
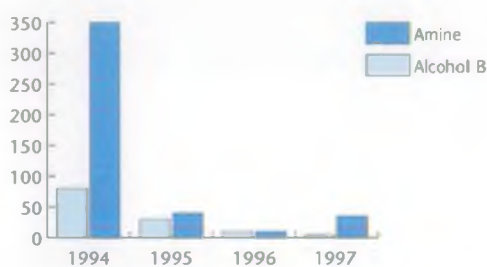
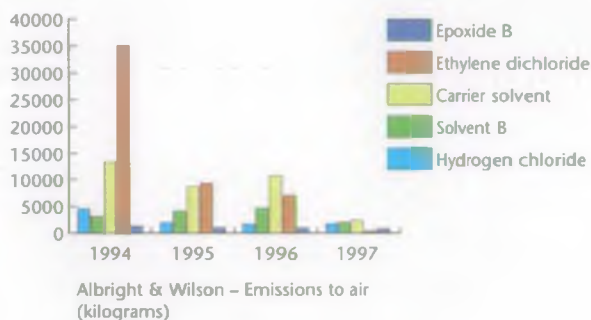
Examples of recent improvements on the site include:

- concrete bunds - retaining walls around storage tanks meet required standards;
- waste disposed off-site to licensed facilities has been considerably reduced over the last four years despite production increasing, as shown in the effluent chart. This trend is set to continue;
- extra abatement equipment has been installed at the P6 plant to reduce emissions to virtually zero in 1998;
- a novel process has been developed by the company for destroying chemicals to eliminate virtually all of a harmful substance, ethylene dichloride, produced as a by-product of making flame retardants.

Conclusion

Mike Minshall, Albright & Wilson's Regulatory Affairs Manager, says: 'Integrated Pollution Control (IPC) can lead to successful outcomes for business and the environment.'

'Implementation of IPC in the chemical industry was initially feared to be at excessive cost but experience has shown that pollution prevention can lead to cost reduction.'



THE AGENCY'S VIEWS

The Albright & Wilson site continues to make good progress against improvements conditions in each of the five authorisations. The authorisations are now in the process of four-yearly review. Pressure will continue to be applied to the company to effectively reduce all emissions towards zero.

In October 1996 there was a major explosion at the plant, which caused minor damage to adjacent sites and a major fire which released several tons of chemical combustion products to atmosphere. The Agency and the HSE jointly investigated and found that the explosion was caused by delivery of the wrong chemical which was then transferred to the wrong tank, where it reacted violently with another chemical feedstock. The HSE has successfully prosecuted the company and a sub-contracted haulage firm for this event.

BG STORAGE

■ Introduction

BG Storage is part of BG plc, formerly British Gas. It is responsible for five liquefied natural gas (LNG) storage facilities including the one at Avonmouth.

The Avonmouth LNG storage facility is a very safe and clean installation used to store North Sea gas in liquid form. This provides a strategic store to safeguard gas supplies to the South West and Wales.

The key feature of LNG is its high rate of delivering gas and the strategic location of the five sites. As a result, LNG can provide a peak supply to gas suppliers and a supplement to network capacity for BG's gas pipeline business, Transco. It also provides insurance against emergencies such as supply failure on part of the gas National Transmission System (NTS). The NTS is the natural gas pipeline network for the UK.

■ What is the process?

Gas enters the Avonmouth site from Transco's NTS through a 'pressure letdown' plant. This plant controls the pressure of the feed gas to the Selexol Plant at 38 bars, about 558 pounds per square inch of pressure.

The Selexol Plant removes most of the trace carbon dioxide from the feed gas before it flows through the liquefaction plant where its temperature is reduced to -158 degrees C. This is done using a mixture of refrigerants - nitrogen, butane, ethylene, propane and methane.

The nitrogen, butane, ethylene and propane are stored in a special area while the methane comes from vaporising some of the liquid gas product. As part of the liquefaction process, the rest of the naturally occurring trace quantities of carbon dioxide and nitrogen is removed from the feed gas.

The liquid gas enters one of three storage tanks which each have a capacity of 21,000 tonnes. Boil-off gas is evolved as a result of heat leakage into the storage tanks. The boil-off gas is heated and compressed before injection into the Local Transmission System.

When gas is needed, the LNG is pumped to vaporisers which heat it to 20 degrees C. Its volume expands about 620 times as it changes back from liquid to a gas. It is then returned to Transco's NTS.

■ How is it regulated?

The Avonmouth site stores 63,000 tonnes of LNG and for this reason is classified as a CIMAH site.

The site is covered by a petroleum licence similar to that of an oil refinery or petroleum storage facility.

It is regulated by the Environmental Protection Act 1990 under Integrated Pollution Control (IPC). Releases to air are estimated by determining the quantity of mixed refrigerant used during the year, by the reduction in stock and by routine monitoring of gas-burning equipment.

BG Storage has a policy of continually reducing emissions which includes an ongoing process of upgrading the control systems used on the site.



BG STORAGE

**■ What are the benefits?**

BG Storage provides gas storage services to a wide range of customers operating in the newly competitive market for natural gas. At the Avonmouth site, storage space and the ability to deliver are sold to customers requiring this service.

With the benefits of natural gas as a clean fuel, the growth in demand for commercial, industrial and domestic gas in the South West has made the need for strategic storage - storing the product in the right place to meet customers' needs efficiently - an important factor in ensuring continuity of supply in the region.

If the gas had to be stored in its natural form, up to 1,800 traditional gasholders - once a feature of many towns - would have to be built around the South West.

BG Storage has 22 employees at Avonmouth and also uses local contractors and services in the local area.

■ What are the site's emergency plans?

Because of the law and the facility's status as a CIMAH site, BG Storage at Avonmouth has its own set of emergency plans which are produced in association with the local authority. These plans will be revised once legislation associated with the COMAH Directive is implemented.

Regular emergency exercises, both on paper and simulated, are carried out on the site with the fire, police and ambulance services. Fire training is regularly carried out and refresher courses held for members of staff.

■ How well has the process performed for the environment?

The plant uses modern technology to liquefy the gas, so emissions are well controlled. The plant is clean and there is little reduction in air or water quality through the operation of the site.

Total volatile organic compound (VOC) releases from the site are limited to 120 tonnes per year by the process authorisation.



BG STORAGE



Since deregulation of the UK gas market, the liquefaction plant has been used increasingly. BG Storage management has recognised that this could increase the quantities of refrigerant gas which have to be vented to the atmosphere as part of the process. A programme of plant improvements continues to take place to minimise and eventually eradicate these losses with self-imposed reduction targets for 1999.

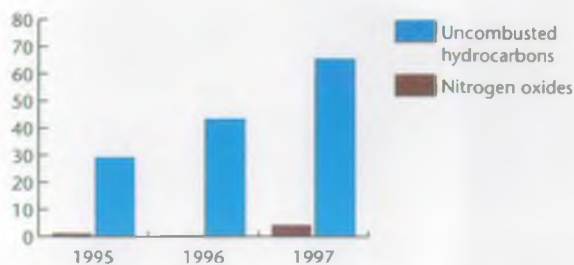
All water discharges from the site flow into two site fire-water ponds. The overflow from the ponds goes into the local rhyne - drainage dyke - but only after passing through a separation interceptor as a final pollution check.

The quality of pond water is regularly monitored. The Environment Agency uses the ponds to conserve and breed stocks of fish including carp and rudd. This is especially important at time of drought as the water level in the pond is constant regardless of weather changes.

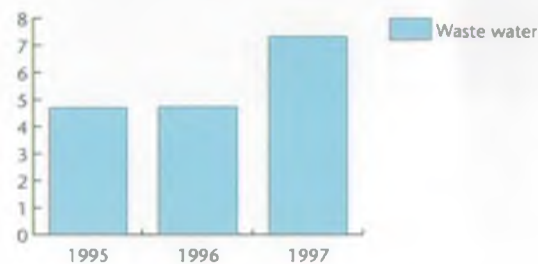
■ Conclusion

Graham Lewis, Storage Engineer at Avonmouth, says: 'BG Storage are using the IPC authorisation process to promote sound environmental management.

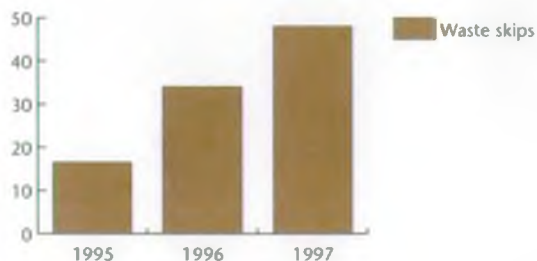
'We will continue to work closely with the Environment Agency to ensure a programme of continuous improvement.'



BG Storage – Emissions to air (tonnes)



BG Storage – Waste water released (cubic metres)



BG Storage – Waste skips (tonnes)



THE AGENCY'S VIEWS

The design of the Avonmouth storage facility and mode of operation reflects the inherent hazards associated with storing large quantities of liquefied natural gas.

Since the process was first authorised in 1993 there have not been any major incidents, or breaches of conditions in the authorisation to warrant enforcement action.

The current improvement programme was set following a review of the original process authorisation. One of the key areas identified for improvement is the reduction/abatement of VOC emissions resulting from shutdowns of the liquefaction plant.

BLAGDEN PACKAGING NV**■ Introduction**

Steel drums are widely used throughout industry, particularly by chemical companies. About four million new drums are made in the UK every year but another five million are reconditioned for re-use.

Blagden Packaging NV, a Belgium-based company with plants in five European countries, is Europe's biggest reconditioner of steel drums. Reconditioning drums saves steel and means fewer drums are put into landfill sites. The company's Avonmouth plant produces 300,000 drums a year.

■ What is the process?

The plant cleans steel drums of 200-210 litre capacity for re-processing. They have contained products which cannot normally be removed by washing out with alkalis or other means. They are collected from customers such as British Steel, ICI, Shell and BP.

The process involves burning out any residues left in the drums after they have been emptied. After passing through a furnace, the drums are shot-blasted inside and out to remove the charred residues from the inside. Then they are re-shaped, given a protective coating and painted before passing through a stoving oven. After undergoing a sophisticated test for leaks, the drums are sent to customers.

Blagden Packaging has pioneered a 'Closed Loop' service. Each customer's used drums are collected, reconditioned and then returned to them.

■ How is it regulated?

The plant is fully regulated under Integrated Pollution Control (IPC). All discharges from the furnace into air are regulated by an authorisation issued under the Environmental Protection Act 1990.

Emission tests on the furnace chimney stack are carried out quarterly by independent emission test environmental consultants. An annual independent test is made by a contractor for the Environment Agency. Certain gases are monitored continually to show concentrations of gases emitted into the atmosphere.



The plant is licensed for emitting volatile organic compounds, mainly solvents, from the areas used for spraying paint and lacquering. The emitted quantities are regularly reported to the Agency.

No water is used in the process. Surface waters go through an effluent treatment plant before entering the public sewer. These discharges are controlled by Wessex Water and monitored by the operator for a variety of substances.

■ What are the benefits?

The plant treats steel drums which are not washable and can only be cleaned by incineration. Without this process, the drums would be crushed and sent to landfill sites. Over time they would disintegrate and the residues would be released into the soil.

The plant's purpose is to recondition empty drums and put them back into use. The benefits include:

- offering customers more economical packaging;
- using steel sheet which would go to landfill or otherwise be recycled in making steel, producing residues and using much more energy;
- discouraging indiscriminate tipping into fields, ponds or rivers;
- saving natural resources - iron ore;
- creating employment for 46 staff, as well as using local contractors and services.



BLAGDEN PACKAGING NV

■ **What are the site's emergency plans?**

The company has its own emergency plans in the event of a fire or other event. No site-specific emergency plan is required as the company does not deal with sizeable quantities of hazardous substances but only with emptied packaging.

If the afterburner - the secondary burner - breaks down or does not fire to the required minimum temperature, drums are not fed into the furnace.

All Blagden Packaging's drivers are trained in dealing with hazardous chemicals. It has strict terms of acceptance for empty drums. Those which have held toxic products must be decontaminated by the customer before the company will accept them.

■ **How well has the process performed for the environment?**

Over the last three years the plant has achieved several environmental goals which have produced a range of benefits.

All yard surfaces have been covered with reinforced concrete and all storage of emptied drums is now within shallow concrete 'bunds' - retaining areas. The benefits include preventing accidental spillages being absorbed in the topsoil. All potentially contaminated surface waters can now be guided into the effluent treatment plant.

A new furnace installed in 1996 enables constant monitoring of gases such as carbon monoxide. It also means more secure processing of drums, resulting in better health and safety conditions for employees and reduced accidental spillages.

A purpose-built system for reducing emissions during drum reconditioning was completed in January 1998. This has now achieved major reductions in emissions of particulates, hydrogen chloride and metals. The equipment is the first of its kind in the UK.

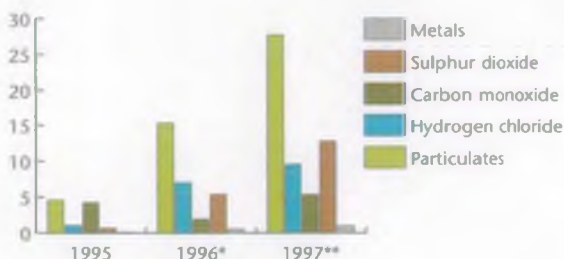


BLAGDEN PACKAGING NV



Blagden Packaging - Emissions to air of dioxins* (milligrammes)

* The data for dioxins is a 'snapshot' taken on a single day. A snapshot taken the following day may show a much reduced level.



Blagden Packaging - Emissions to air (tonnes)

* After March 1996 the volumetric flow rate through the furnace quadrupled from 4.4-4.5 cubic metres a second to 18-20 cubic metres a second.

** An abatement system completed in January 1998 has achieved major reductions in emissions of particulates, hydrogen chloride and metals.

In the new system, exhaust gases from the furnace pass through 480 polyimide bags coated with lime which removes chemicals from the gases. Lime contaminated with particulates and metals drops to the bottom of the filter chamber and is taken away to landfill sites.

The system is particularly good at removing particulates. Since its installation, the chimney stack no longer produces the black smoke which used to cause complaints by local residents.

Conclusion

Chris Scapens, Plant Director for Blagden Packaging, says: 'We are very grateful to the Environment Agency for their constant and effective supervision of the environmental performance of the site.'

'The Agency helps us apply the principles of Best Available Technology Not Entailing Excessive Cost (BATNEEC) to our site-specific conditions. It also provides constant stimulation on future EC Directives and legislation.'



THE AGENCY'S VIEWS

The Blagden site has made great strides in recent years to upgrade facilities, and its furnace and associated equipment, and is the leader in the UK as a drum incinerator.

Implementation of the Hazardous Waste Incineration Directive will place ever more stringent conditions on the plant, which need to be met by June 2000.

Continuous monitoring for various acid gases and particulates will provide more detailed information to help the company get the best out of the process.

BRITANNIA ZINC LTD

■ Introduction

Smelting of zinc has been carried out at Avonmouth for more than 70 years. Britannia Zinc Ltd (BZL) produces much of the UK's zinc as well as lead and other products. The company is investing £2 million in improving its blast furnace ventilation to minimise the release of metal particles to the air.

■ What is the process?

Zinc and lead are made by the company using the Imperial Smelting Process. This was pioneered by engineers at Avonmouth as the first commercial process to extract both metals at the same time. The process is now used around the world.

Zinc and lead concentrates are shipped into Avonmouth Docks from Australia, North and South America and elsewhere. The other raw materials used are coke, mainly from South Wales, limestone and fluxes, which are chemicals used in smelting.

In the Imperial Smelting Process, the zinc and lead concentrates are mixed and 'sintered' - formed into large lumps. The metals are then extracted in a blast furnace. As well as producing refined zinc, the process yields refined cadmium (a metal), lead bullion and sulphuric acid.

An important feature is the large number of recycling procedures. Metals are recovered from all materials which are by-products or wastes from the process. Metal-bearing residues and wastes from other sources in Europe are also recycled into the process to recover the useful metals. BZL has invested £2.2 million on technology to increase its ability to recycle metal-bearing dusts by direct injection to its furnace.

■ How is it regulated?

Under the Environmental Protection Act 1990, two areas of regulation apply at BZL.

One is Integrated Pollution Control (IPC). Under this, BZL had to apply for an authorisation to operate. This required a detailed submission to the Environment Agency of the process operation, techniques for reducing pollution and the site's environmental impact. Authorisation was granted and operations under IPC started in January 1996.

Under IPC, BZL regularly monitors 12 of its chimney stacks for dust particles containing heavy metals and two other stacks for sulphur dioxide, a gas. Water effluent is also monitored and samples are analysed for lead, zinc, cadmium and other metals. The Agency also carries out its own spot checks on chimney stacks and water effluent.

An important feature of IPC is an improvement programme which requires BZL to make changes over a given timescale. Improvements already made include better monitoring and analytical equipment and environmental studies of air quality and effluent quality.

One current project is a £2 million improvement to the ventilation and gas cleaning systems in the blast furnace. The aim is to reduce dust emissions by fitting an advanced filtration system to recover the dust which contains the lead particles.

The other area of regulation is waste on land. The blast furnace produces about 100,000 tonnes of granulated slag a year which is deposited as landfill on the site. This requires a waste management licence to ensure correct



BRITANNIA ZINC LTD



day-to-day control of the slag tip. In addition, planning conditions require that when an area is complete, it is covered with soil and planted with trees and other vegetation.

BZL is looking at other ways of marketing the slag in a 'sustainable development' approach. One possibility is substituting it for the sand and gravel used as aggregates in making concrete or other building products.

■ What are the benefits?

BZL operates the UK's only primary zinc smelter and produces 100,000 tonnes a year. It supplies about 45 per cent of the UK zinc market, the rest has to be imported. Half the zinc is used in galvanising steel products, 15 per cent in brass-making, 15 per cent in diecasting and the rest in making chemicals and medicines.

The site also produces about 55,000 tonnes of lead, mainly for making batteries, and about 250,000 tonnes of sulphuric acid, which is used in making fertilizers and specialist chemicals.

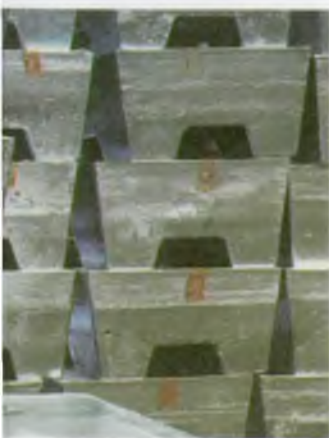
BZL employs about 500 people and another 100 people work on the site as engineering and service contractors. The company's contribution to the local economy is around £30 million a year. A further £13 million is spent on coke from South Wales.

■ What are the site's emergency plans?

Most emergency releases to air on the site are short-term events where the processes can be shut off quickly. Since 1993 there have been major advances in systems for controlling the acid plant to minimise releases of sulphur gases due to any process upset.

Water pollution is considered to be a higher risk, so the company has invested in better containment of the mercury removal plant. It is also planning to build extra containment around the sulphuric acid storage area.

BRITANNIA ZINC LTD



■ How well has the process performed for the environment?

The Imperial Smelting Process is considered to be the best available technology for smelting mixed zinc and lead ores. One extra advantage is that all unwanted materials end up as a hard glassy slag which is relatively inert.

Lead releases to the air are regarded as an important sign of plant performance. These have been falling steadily, from nearly 6 kilograms an hour in 1988 to less than 3kg an hour in 1997.

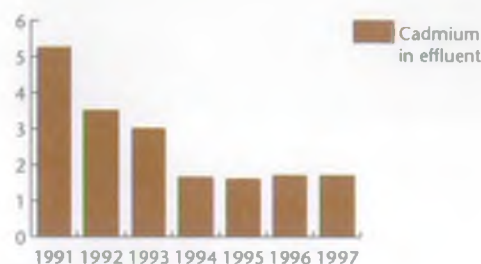
Releases of heavy metals such as cadmium in effluent have been progressively reduced. This has been mainly achieved by reducing the volume of water discharged through recycling. Cadmium levels in effluent have fallen from more than 5kg a day in 1991 to less than 2kg a day in 1997.

■ Conclusion

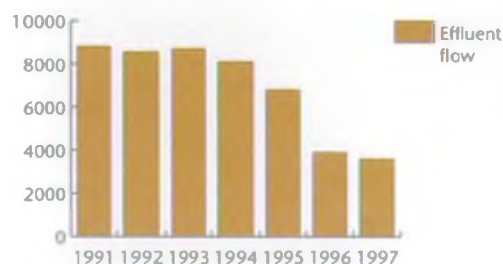
Adrian Nash, BZL's Environment Superintendent, says: 'The IPC regime is particularly challenging to BZL. This strict regulatory process does offer all our stakeholders - employees, the community and our customers - the confidence that the quality of air and water around us has improved and will continue to improve.'



Britannia Zinc – Emissions to air of lead (kilograms per hour)



Britannia Zinc – Cadmium in effluent (kilograms per day)



Britannia Zinc – Effluent flow reduction through water conservation (cubic metres per day)



THE AGENCY'S VIEWS

BZL is committed to a programme of improving reduction of pollution during the numerous process stages. This mainly entails splitting 'dry' air streams from 'wet' ones and employing bag filters wherever possible to improve the capture of particles. This is then enhanced by looking for improved performance from the remaining 'wet' systems.

The process is the major emitter of sulphur dioxide in the area and BZL is investigating improved reduction techniques which will ensure that the more stringent air quality standards from the year 2005 onwards are not compromised. This will involve major capital investment.

BZL has considerably reduced the amount of water used on site. This is always difficult to achieve without increasing the concentration of pollutants in the remaining effluent stream.

CHEMICAL RECOVERIES LTD

■ Introduction

Chemical Recoveries Ltd has been processing waste liquids since 1963. It specialises in the recycling of contaminated industrial solvents, oils and water.

The company's 3.3-acre Avonmouth plant is one of the UK's leading recovery sites. In 1997 it processed more than 45,000 tonnes of other companies' waste and sold recovered solvents, oils and fuels worth over £1.5 million.

The volumes processed have grown by over 20 per cent a year in the last five years while the site has improved in performance and appearance.

■ What is the process?

Chemical Recoveries collects and processes everything from a one-litre can to 30,000-litre road tanker loads. The work is limited to commercial and industrial users; no business is carried out with the public.

A complete recycling service is provided to more than a thousand customers whose solvents or oils are recovered for their re-use. Another thousand companies use the facilities to dispose of their wastes through the site's treatment processes.

Typical customers are manufacturers or users of paints, inks and allied products, particularly vehicle and steel makers. They use solvents mainly for cleaning plant and equipment such as spray guns. The waste solvents contaminated with paints, inks, pigments, resins and other material go for recovery or recycling.

Many of the solvents handled by the works are contaminated with high levels of sticky, viscous solids and the best way to recover them is by 'live steam distillation'. This process involves the injection of steam into the waste solvent mixture. The steam provides heat to evaporate the useful solvent and is safer than a traditional distillation process for these sticky mixtures. However, the residue from the process contains large amounts of water, so it cannot be burnt but must be disposed of to landfill.

Therefore, solvents which are less viscous are recovered by another distillation method, a 'wiped film evaporator'. In this process, the solvent mixtures are contained in a still, the walls of which are heated. Within the still are three rotating blades which scrape the inside walls. These ensure that the heating efficiency is maintained and that the residues are kept mobile and do not solidify in the still. The residues from this process are assessed and blended into support fuels for incinerators and cement kilns.

The recovered solvents are given further treatment and then usually re-used as an industrial cleaning solvent or paint thinner. Some solvents unsuitable for recycling as thinners or in cleaning are tested and blended as an alternative fuel.

Oils are recovered by being heated and separated to remove water and solids. Then the oils are blended for use as an alternative fuel. This has a much higher calorific value than solvent-derived fuels and lower levels of contaminants. It is used by roadstone and power plants as a viable alternative to heavy fuel oil.

Other treatment methods include filtration, thermal and chemical cracking, physical separation and blending.

■ How is it regulated?

Chemical Recoveries is licensed for the recovery and transport of all the wastes it handles. The processes involved are licensed by the Environment Agency under the Environmental Protection Act 1990.

Substantial investment in environmental improvements such as a wiped film evaporator and an oil scrubber, enables the company to meet all the regulatory requirements and further improve its processes. In 1997 alone this work cost more than £250,000, nearly 10 per cent of the site's turnover.

New equipment is being continuously introduced to control emissions and improve efficiencies. Training, monitoring and compliance procedures are being increased.



CHEMICAL RECOVERIES LTD**■ What are the benefits?**

The plant recovers and recycles up to 20,000 tonnes of waste solvents a year and up to 50,000 tonnes of oils and water. These would be a substantial cause of pollution to water, air and land if left untreated.

It employs the Best Practicable Environmental Option to recover waste solvents and oils for re-use. The aim is to minimise the levels of pollutants reaching the environment as well as providing high quality recovered products for re-use by industry.

Chemical Recoveries and similar companies reduce the volume of solvents and oils made and consumed in the UK. This reduces the amount of waste and attendant pollution. Through recycling, recovery companies reduce the quantity needing disposal and the volume of virgin solvents and oils manufactured. This is regarded as the best option for the environment.

■ How well has the process performed for the environment?

The percentage of emissions to air, land and water from the site declined by more than 25 per cent between 1993 and 1997 because it was processing waste more efficiently. Yet production on the site increased by more than 50 per cent in the same period.

The actual releases are shown in the graphs opposite which show the emissions totalled by concentration for the boiler plants and as annual totals for volatile organic compounds (VOC) - the two main sources of releases to the air.

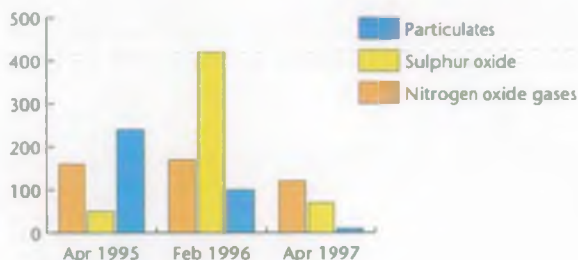
The high particulate figure on boiler emissions occurred during problems with a burner on the boiler in December 1996 and only occurred for about a week. The replacement burner and fuel changes in 1997 have significantly reduced particulate levels.

The site's largest source of emissions is solvent-laden air from the vacuum pump which moves solvents around the site. A generator is being installed which will burn the solvent-laden air

CHEMICAL RECOVERIES LTD



Chemical Recoveries – Calculated annual emissions to air for volatile organic compounds (tonnes)



Chemical Recoveries – Boiler emissions (milligrammes per cubic metre)

as fuel after it has passed through a kerosene scrubber to remove VOCs. It is expected that this improvement will dramatically reduce emissions from the solvent plant.

Waste oil used to be burnt on site to generate steam, which created emissions. The company has now switched to gas or oil boilers which have further reduced emissions.

Until recently there was no discharge of effluent off the site and all waste water had to be taken away in road tankers. With the consent of the Agency and Wessex Water, the site was connected to the main sewer in September 1997. A treatment plant is being installed to remove contaminants before water enters the sewer.

Conclusion

Nick Roads, Chemical Recoveries' Sales Director, says: 'We provide a valuable service to industry and public in the UK by treating other companies wastes.

'We do produce emissions and waste but we will continue to invest in new techniques and processes that reduce these emissions. The overall benefit to the UK and local area is much greater than the impact these emissions have.

'We need processes that are well regulated, monitored and run. Integrated Pollution Control helps to achieve this but it must be measured against the benefits of the products each process produces.

'Information about our process and our emissions is available on our website at: www.chemrec.co.uk



THE AGENCY'S VIEWS

Operation of the site represents a good example of Best Practicable Environmental Option. Wastes that enter the site are treated, oil or solvents are recovered for re-use and most of the remaining wastes are now being diverted to act as secondary fuels in other industries. All watery waste will be treated on site and discharged via sewer to the Avonmouth sewage treatment works. This removes the transportation and handling problems arising from road tanker traffic; a substantial benefit to the environment.

Ongoing site improvements are still being sought and VOC emissions should reduce still further in the near future.

RHODIA ORGANIQUE FINE LTD**■ Introduction**

Rhodia Organique Fine Ltd recently changed its name from Rhodia Ltd. The French parent company Rhone-Poulenc is one of the world's leading life science and speciality chemical manufacturers. The group operates in more than 140 countries.

Rhodia's Avonmouth site occupies 70 acres. It has four main manufacturing plants for hydrofluoric acid, Isceon, anaesthetics and fluoroaromatics. It also has multi-purpose development and laboratory facilities.

■ What is the process?

There are nine processes on the site regulated under seven authorisations issued under the Environmental Protection Act 1990.

The regulated processes are the hydrofluoric acid plant, the fluoroaromatics plant, the multi-purpose plant making specialist chemicals, the potassium fluoride plant, two anaesthetics plants, two Isceon plants, large-scale laboratories and the effluent treatment plant.

■ How is it regulated?

The site is covered by the 1990 Act and is governed by Integrated Pollution Control (IPC). Rhodia is required to operate all its processes in line with the Best Available Technique Not Entailing Excessive Cost (BATNEEC). This includes not only the equipment used but also the management system, design, maintenance and training.

The principles of IPC complement Rhodia's own environmental policy. The main features of the policy are:

- meeting all relevant regulations;
- keeping waste and emissions to a minimum;
- having an open relationship with the community;
- improving the site's appearance;
- following an environmental management system.

■ What are the benefits?

Hydrofluoric acid's main use is in the 'catalytic cracking' of petrol which helps to make lead-free fuel, which is less damaging to the environment and health than leaded petrol. The acid is also used in making circuit boards.

Inhalation anaesthetics made on the site - Isoflurane and Halothane - are widely used in hospital surgery.

The fluoroaromatics made at Avonmouth are intermediate chemicals used in the making of drugs. The site's Isceon plant produces CFC gases for use as propellants in the inhalers widely prescribed for the relief of asthma.

About 250 people are employed on the site. During 1996, £340,000 of the capital budget was spent on environmental improvements.



RHODIA ORGANIQUE FINE LTD**■ What are the site's emergency plans?**

All plants and processes on the site are carefully designed and detailed risk studies are made to ensure they run safely and efficiently. There are multiple safety devices to prevent any emergency occurring in the first place.

The plant is a Control of Industrial Major Accident Hazards (CIMAH) site. Emergency preparedness is taken very seriously throughout Rhodia and at Avonmouth there are detailed emergency plans.

The staff work closely with the emergency services to ensure that in the unlikely event of an emergency, the relevant personnel are trained to deal with it efficiently. Regular exercises - both on paper and simulated - are held with the emergency services.

There is a dedicated team of experts who are available 24 hours a day and contactable by a paging system to ensure there is the expertise to deal with any situation.

■ How well has the process performed for the environment?

Emissions from the processes are monitored regularly and the results reported to the Environment Agency.

Since coming under IPC in 1993-94, major improvements have been made to the processes to ensure they operate with minimal effect on the environment. Two further major projects with environmental considerations are under way. All these projects have improved Rhodia's environmental performance in line with IPC requirements and the company's own policy of continued improvement.

Effluent treatment plant - A £1.25 million plant was commissioned in 1993 to make sure that effluent leaving the site complies with authorised limits.

Multi-purpose plant - A complete emissions scrubbing system has been fitted to enable the plant to make many different products while protecting the environment.

Isceon plant - A new recovery system has reduced its emissions to the atmosphere from 84 tonnes in 1995 to 18 tonnes in 1997.



RHODIA ORGANIQUE FINE LTD

Storage - Storage facilities have been assessed and bunds - retaining walls - installed to prevent any leakages or spillages that may occur from entering watercourses.

Boilerhouse - An improved boiler management system has been installed to ensure effective operation and emissions reduction.

Isceon 22 plant - The plant is undergoing a study to improve the efficiency of the process and thus reduce the emission of a greenhouse gas. Initial work has indicated reductions in emissions by 50 per cent.

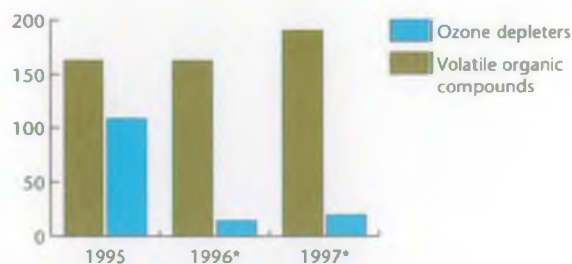
Fluoroaromatics plant - The plant has a major new project enabling a new product to be made. Much of the project is devoted to improving the plant's safety and environmental performance, at a cost of about £1.6 million.

■ Conclusion

Chris Morris, Rhodia's Environmental Manager at Avonmouth, says: 'The principles of IPC complement Rhodia's own policy which is a commitment to continuous improvement and sustainable development.'

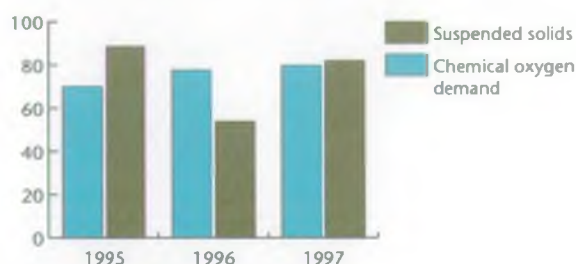
'For Rhodia, sustainable development is all about marketing increasingly effective and economical products under conditions of production and end-use that increasingly respect the environment.'

'As a major local manufacturer we do everything we can to make our processes more efficient while improving our health, safety and environmental performance.'



Rhodia - Emissions to air (tonnes)

* Since 1995 the number of emissions monitored has increased and the reliability of monitoring has improved. These changes in monitoring have the effect of masking reductions in emissions that have taken place.



Rhodia - Effluent discharges (tonnes)



Rhodia - Effluent discharges (tonnes)



THE AGENCY'S VIEWS

The Rhodia site will continue to work towards ever-toughening emission standards; some plants are already at almost zero release levels, whilst others are working towards this goal.

The COMAH Directive, superseding CIMA, will have major implications for the site in the near future. A detailed safety report must be prepared and made available for public consultation together with on- and off-site emergency plans in the event of an unforeseen accident. The implications on the immediate and local environment will be assessed and plans developed to minimise the potential effects.

SEABANK POWER LTD

■ Introduction

A natural gas power station is being built by Seabank Power Ltd to the north of the Avonmouth area. The site used to be a town gas works which closed in the 1970s.

The 'combined cycle gas turbine' power station at Hallen is due to start operating in 1999. It will produce enough electricity for three-quarters of a million people.

Seabank Power is a joint venture between BG plc and Scottish and Southern Energy. Both companies have extensive experience in large gas and electricity projects.

■ What is the process?

The first phase of the Seabank power station will use two high-efficiency gas turbines combined with a steam turbine to give a total output of 755 megawatts of electricity. The gas turbines draw natural gas from BG's national pipeline network.

A 42-inch diameter pipeline has been laid to transport gas 16 miles to the site from a new compressor station at Pucklechurch, east of Bristol.

The diagram of the power station (see page 25) shows how the process works. Air is compressed, gas added and then the mixture is burned. The resulting hot exhaust gas drives the gas turbines which in turn drive generators to produce electricity. The electricity generated is fed into the national grid.

Much of the energy produced by the burning is carried away in the exhaust gas. This heat energy passes to the 'waste heat recovery boilers'. There it heats water to produce high-pressure steam. This steam drives a separate steam turbine which in turn drives another electrical generator.

By combining these two cycles of gas and steam, higher efficiency can be obtained than in a conventional power station.

■ How is it regulated?

Seabank power station has had to obtain Integrated Pollution Control (IPC) authorisation under the Environmental Protection Act 1990. This is because it is a large-scale combustion process.

The main waste streams are exhaust gas emissions to the atmosphere and liquid effluent. The gas emissions are constantly monitored with automatic equipment. The liquid effluent is sampled regularly.

■ What are the benefits?

A continuing increase in demand for electricity, combined with existing power stations reaching the end of their useful lives, means that new, more efficient power stations are needed to replace older ones.

Most electricity is generated in the midlands and north but more people live in the south of England, so the demand is greatest there. It is more efficient to site new power stations nearer to the people they will serve. This is because some power is lost through transmission over long distances.



SEABANK POWER LTD



Seabank Power says its station will be clean, quiet, odourless, dust-free and very efficient. Its design efficiency will be greater than 57 per cent, while the best that can be achieved by today's coal-burning power stations is less than 40 per cent.

Higher efficiency reduces the environmental effects of electricity generation as less fuel is used and emissions are reduced to make the same amount of electricity.

The site will employ about 45 people full time and make extensive use of local contractors and services. Seabank Power estimates that it will contribute several million pounds a year to the local economy.

■ What are the site's emergency plans?

Seabank Power will have extensive emergency plans for the site in conjunction with the emergency services. The emergency plan for the pipeline is already in place.

■ How well has the process performed for the environment?

Seabank Power has an IPC authorisation which sets limits for releases to air and water. In its IPC application, Seabank Power Ltd projections for its main emissions to the atmosphere are:

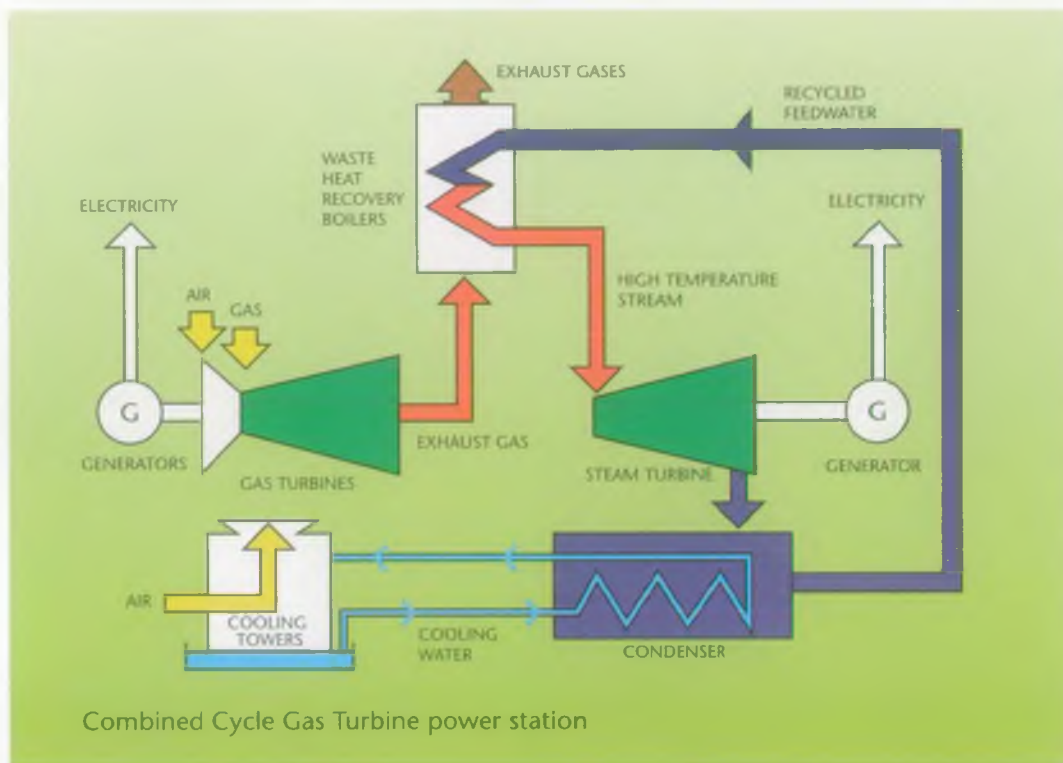
- carbon dioxide: about 3.4 million tonnes a year;
- oxides of nitrogen: approximately 3,000 tonnes a year;
- sulphur dioxide: less than 70 tonnes a year.

Seabank power station will produce far less pollutants than an equivalent coal-fired power station. For example, burning coal would produce about 8.25 million tonnes of carbon dioxide alone in a year.

With natural gas, not only are gaseous emissions reduced but there is no solid ash to remove to a landfill site.



SEABANK POWER LTD



The site's cooling system will use 8.5 million cubic metres of 'greywater' a year. Greywater is cleaned municipal effluent and will be supplied by Wessex Water from the Avonmouth sewage treatment works. Using greywater means that the cooling towers will not have to draw on mains water, an increasingly precious resource.

■ Conclusion

Seabank Power Ltd believes that IPC is a valid method of ensuring that the public and the environment are protected. It recognises the benefits of IPC for industry and is confident that IPC regulation by the Environment Agency provides an adequate level of protection.



THE AGENCY'S VIEWS

This plant uses the latest design of industrial gas turbine, and emission limits have been set to reflect the highest standards.

The plant is currently in its extended commissioning phase but should enter beneficial operation in early 1999. Commissioning has not been without its problems (notably a release of 'cold' steam which severely reduced visibility in the area of Pilning and the failure of a new acid tank which caused acidic fumes while the incident was being resolved). The Agency is maintaining close contact with both Seabank and Siemens (the main contractor) to ensure that appropriate action is taken and that lessons are learnt.

SEVALCO LTD



■ Introduction

Sevalco Ltd is one of only two carbon black manufacturers in the UK. Carbon black, mainly used to reinforce tyres, has been produced on the Avonmouth site since 1951, originally by Philblack Ltd and since 1972 by Sevalco. In 1988 the company was acquired by Columbian Chemicals Company, part of Phelps Dodge Industries. The plant currently employs 145 people.

■ What is the process?

Carbon black is made from a heavy aromatic petroleum-based feedstock. The oil is delivered to the plant by road tanker or by pipeline from the Avonmouth oil terminal.

The oil is pumped into a specially designed furnace where it is heated under pressure to around 850 degrees C. This 'cracks' the oil to produce a gas stream laden with carbon black.

The gas stream passes through filters where the carbon black is separated from the gases. The carbon black then goes to the beading plant to be turned into granules, using water to bind the powder together. The granules pass into a dryer and are then packaged for delivery to customers.

■ How is it regulated?

The process is a long-established technology regarded as efficient and cost-effective. The plant operates under a single authorisation from the Environment Agency under the Environmental Protection Act 1990.

Sevalco was one of the first companies to be regulated under Integrated Pollution Control (IPC). Its authorisation was granted in 1993. A variation to the authorisation was granted in November 1997 following improvements to the process costing £17 million.

These improvements included installing a new production unit to increase capacity, putting in a more efficient boiler run on waste gases from the plant, building two new chimney stacks and reducing emissions on an existing stack.

■ What are the benefits?

Carbon black has many uses in manufacturing industry. The main use is as a reinforcing agent in making tyres. Hard carbon black is used in the tread and softer carbon black in the walls of the tyre.



SEVALCO LTD



Without carbon black, tyres would only last for about 3,000 miles. With carbon black they last for around 35,000 miles. Other uses include protecting plastics from ultra-violet rays and as a pigment.

Without the existence of the Sevalco plant, 40 per cent of the UK's requirement of carbon black would have to be imported. About 25 per cent of production from the plant is exported.

As well as employing 145 people directly, Sevalco makes extensive use of local contractors and suppliers.

■ What are the site's emergency plans?

The Sevalco plant is regarded as a low-risk site but has contingency plans in place in the event of any emergency. Regular visits from fire crews of Avon Fire Brigade help them get to know the site.

■ How well has the process performed for the environment?

Sevalco has achieved all its objectives in minimising emissions to air. In 1997 two new 65.5-metre chimney stacks were built to improve the dispersal of emissions. An improved abatement system was also installed: a scrubbing system using water to clean exhaust gases was replaced with a more efficient dry filtration system.

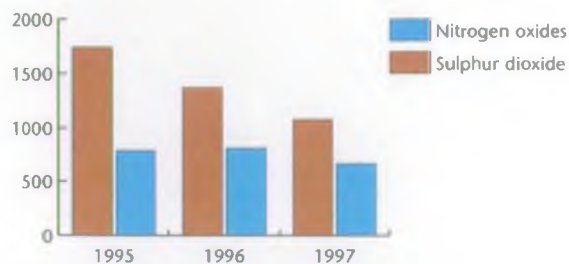
During 1999 the company aims to improve the drainage system. It plans to install a settlement system to remove impurities before the water is discharged.



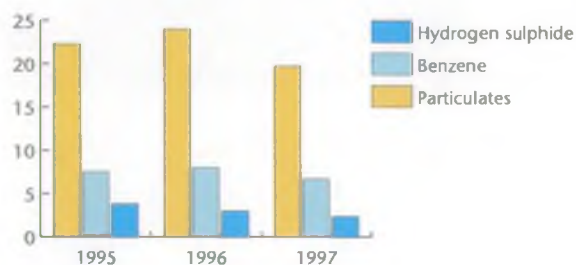
SEVALCO LTD**■ Conclusion**

Steve Buckner, Sevalco's General Manager, says: 'As a company we have actively looked to work in partnership with the regulatory authorities, to be forward thinking and to be ahead of what is required of us.'

'We are looking to demonstrate what can be achieved in good environmental management in a process like ours. Integrated Pollution Control gives us that opportunity.'



Sevalco – Emissions to air (tonnes)



Sevalco – Emissions to air (tonnes)

**THE AGENCY'S VIEWS**

Sevalco made significant investments in the site during 1997. These were in new process equipment and improved emissions reduction on existing plant. These improvements mainly concerned releases to air; work is now in progress to review/improve site drainage and to reduce levels of pollutants in releases to the Severn Estuary.

TERRA NITROGEN (UK) LTD

■ Introduction

Terra Nitrogen (UK) Ltd is the UK's largest manufacturer of nitrogen fertilizer, which is used in agriculture. The company was recently bought from ICI by the American corporation, Terra.

Sevenside Fertilizer Works was commissioned in 1962 and has a capacity of 500,000 tonnes a year. The site employs leading-edge technology and operates two of the world's first fully computer-controlled ammonia plants.

■ What is the process?

Production is based on three raw materials: gas, water and air. Gas is piped in from the national gas grid and water from the neighbouring Sharpness supply.

The main products are Nitram straight nitrogen fertilizer and a range of blended fertilizers with specialist uses - Kaynitro, Grazemore and Sulphur Gold.

The by-products from fertilizer production are carbon dioxide and ammonia. Both are processed on site and sold for specialist purposes. Liquid carbon dioxide is used in heat exchange in nuclear power stations, in fizzy drinks, horticulture and metal foundries. Ammonia solution is used in making yeast, treating timber and metal, in household cleaners and other uses.

Ammonia plants - Ammonia is produced by extracting hydrogen from natural gas in a catalytic reaction with steam, and nitrogen from the air in a separate reaction. The hydrogen and nitrogen are then combined to form ammonia in a pressure system over a further catalyst. Ammonia is stored as a liquid in three storage tanks.

Nitric acid plants - Nitric acid is made by the reaction of ammonia with air over a catalyst to produce oxides of nitrogen which are absorbed in water to produce nitric acid.

Fertilizer plant - Nitric acid is neutralised with gaseous ammonia to give ammonium nitrate solution which is then concentrated in special evaporators. The concentrated liquor is sprayed down a 328ft tower where it solidifies into small 'prills' of Nitram.

Blending plant - Nitram is blended with additional ingredients: ammonium sulphate to make Sulphur Gold, sodium nitrate to produce Grazemore, and potash to make Kaynitro, each for particular crops.

Carbon dioxide plant - Carbon dioxide is compressed, refrigerated and stored as liquid for distribution by road tankers.

Ammonia solution plant - A small amount of ammonia is converted to ammonia solution which is transported away in road tankers.

■ How is it regulated?

Sevenside Fertilizer Works is authorised to operate as a fertilizer production unit in compliance with the Environmental Protection Act 1990. The site operates within a licence issued by the Environment Agency. It routinely supplies the Agency with production and environmental performance data as required by the licence.

The works are subject to the Control of Industrial Major Accident Hazards (CIMAH) regulations. The company therefore provides:

- written safety reports showing what is to be done to ensure safe design, process and management control;



TERRA NITROGEN (UK) LTD



- written on-site emergency plans with practices to ensure control of any site emergency;
- full information to enable off-site emergency plans to be prepared by local authorities. These plans include public notification within a defined zone so that local people know exactly what to do in the event of an emergency affecting them.

The specialised knowledge of site staff in the safe manufacture and handling of hazardous substances minimises the risk of accidents. It also puts staff in the best position to deal with any incident.

■ What are the benefits?

Using ammonium nitrate fertilizer such as Nitram is the only way the UK can retain self-sufficiency in food production. Without self-sufficiency the country would rapidly become a massive importer of food at substantially higher prices. The UK relies on highly efficient food production methods to achieve self-sufficiency. These methods depend on nitrogen-based fertilizers which can be made naturally, as farmyard manure, or as ammonium nitrate.

But there is simply not enough manure to go round. To reach current levels of food production with manure would need six times the current number of cattle, much more grazing land and the delivery of 50,000 truck-loads of manure to farms every day - not a practicable idea.

Sevenside Fertilizer Works employs 250 people directly or indirectly. It is involved in the local community at many levels. Local schools and colleges are supported through an active education liaison programme.

Over the last 10 years £60,000 raised through the company's Site Incentive Scheme has been given to 120 local causes. The scheme contributes to a special fund for every month the site does not lose working time through an accident.

The site sponsors a local Environmental Liaison Committee with representatives of the local authority, parish councils and the company. The aim is to encourage a dialogue on all aspects of site activities and plans that may concern residents. The site also operates a local phone helpline and distributes a site environmental annual report to all residents.

TERRA NITROGEN (UK) LTD**■ What are the site's emergency plans?**

Terra Nitrogen (UK) Ltd considers site safety and safe working of paramount importance. Severnside Fertilizer Works is part of an external chemical emergency scheme. This defines detailed plans for handling all types of incident in co-ordination with the emergency services, local authority and neighbouring chemical sites.

As part of the scheme, the works co-operates with neighbouring sites and has at times mobilised its own emergency team to help with outside incidents.

Comprehensive written procedures covering every eventuality are integrated with local authority plans. Emergency procedures are regularly tried out with the emergency services and local authority.

■ How well has the process performed for the environment?

Terra Nitrogen (UK) Ltd subscribes to the Chemical Industries Association's Responsible Care programme of continuous improvement in the best practices of safety, health and environmental management. In 1993 Severnside Fertilizer Works co-published the Responsible Care guide to the chemical factories in Avonmouth which was distributed to local residents.

Terra Nitrogen (UK) Ltd, in co-operation with the Agency, is continually seeking ways of improving the environmental performance of the works. Some of the projects use cutting-edge technology. Others have been used successfully in Terra's plants in the USA.

Data on discharges of substances to the air, water and landfill is collected continuously at the works and reported to the Agency each year. The data in the graphs on page 32 should be read in conjunction with the notes which show changes in reporting requirements, increased knowledge gained during operations and one-off events.



For the past 25 years Severnside Fertilizer Works, in co-operation with the Agency, has monitored the ability of the River Severn to support living organisms. Effluent from the site discharges into the estuary.

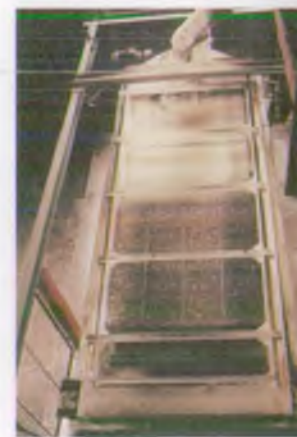
The company has conducted annual measurements of the levels and types of flora and fauna on the river bed and its banks upstream and downstream of the site. The results demonstrate that the factory effluent has no harmful effect on the river environment. A £1.9 million project approved last year will further guarantee this by reducing concentrations of ammonium nitrate in the site effluent.

During 1999 a new selective catalytic system will be installed which will radically reduce nitrogen oxide gases from the nitric acid plant without the side production of ammonia.

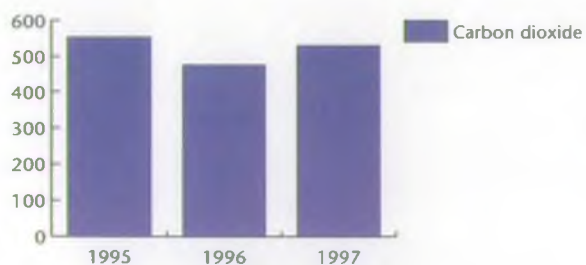
■ Conclusion

Graham Foster, Personnel Services Manager at Severnside Fertilizer Works, says: 'Integrated Pollution Control is an excellent system for co-ordinating all our process improvements to reduce the overall environmental burden.

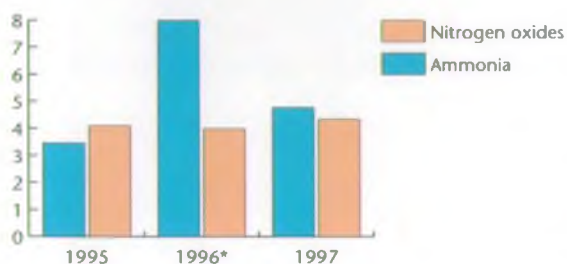
'It has enabled us to work closely with the Environment Agency, talking a 'common language' as we develop agreed, realistic, sustainable environmental goals for our future operations at Severnside.'



TERRA NITROGEN (UK) LTD



Terra Nitrogen – Emissions to air
(tonnes per 1000 tonnes of product)



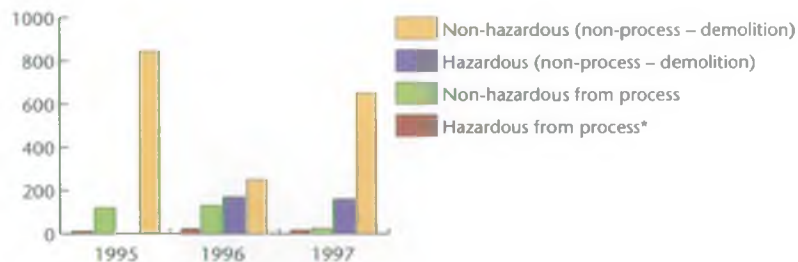
Terra Nitrogen – Emissions to air
(tonnes per 1000 tonnes of product)

* Before 1994 it was not appreciated that the Nitric Acid plant absorbent system produced ammonia while removing nitrogen oxides gases. The figure for 1995 was based on very little good data. The 1996 figure is a more accurate reflection of the amount produced rather than an increase.



Terra Nitrogen – Discharges to water
(tonnes per 1000 tonnes of product)

The concentration of substances in the total liquid discharge is very low. Hazardous compounds are less than 0.005 tonnes per 1000 tonnes of product.



Terra Nitrogen – Discharges to landfill
(tonnes per 1000 tonnes of product)

* This increase results from reclassification of materials and is not an increase in discharges of hazardous materials.



THE AGENCY'S VIEWS

The operator is committed to a number of projects which will significantly improve the environment. Notable among these are:

- A project to ensure that there is capacity to hold heavily contaminated water from any incident on the Nitram Plant and prevent excessive levels of ammonia and/or nitrates being discharged into the Severn Estuary. This project was initiated following the Agency's enforcement action in response to an incident.
- Replacing the current abatement on the release of oxides of nitrogen with a technique which should greatly reduce the frequency of 'brown stacks' (visible emissions of orange/brown smoke).

ZENECA LTD**■ Introduction**

Avlon Works at Avonmouth is one of Zeneca Pharmaceuticals' two manufacturing sites in the UK. It occupies a key position in producing active pharmaceutical ingredients for the international business.

The site is designed for large-scale manufacture. It has traditionally produced the active materials Inderal and Tenormin for the control of high blood pressure.

It also produces Hibitane and Cetrimide which are widely used as antiseptics. Their uses include creams for protecting skin abrasions and disinfecting the surgeon's skin before hospital operations.

The range of active ingredients manufactured by the Avlon Works is being expanded to include Zeneca's new medicines - Accolate for the treatment of asthma and Seroquel for treating patients with schizophrenia. Zeneca has also invested in a new plant for the manufacture of new drugs which are being developed.

■ What is the process?

The processes for producing the antiseptic products are relatively simple chemical reactions. Each produce the material as a liquid ready for formulation into the final product for sale to the customer.

The other processes for manufacturing pharmaceutical ingredients are very complex. Each process consists of several chemical reactions which progressively build simple chemicals into the final active pharmaceutical.

These chemical reactions are all carried out in specially designed equipment which ensures that materials are properly contained so that they do not pose a risk to people or the environment. The active material is then transferred to other facilities within the Zeneca Group for final purification. It is then used to produce the final dosage form, such as tablets or injections, for prescription to the patient by their doctor.

As part of the programme to develop a new medicine, material has to be manufactured in small amounts for use in clinical trials. This material is produced in the site's development plant. This plant is similar to the one for making pharmaceuticals for sale but it can be changed rapidly to accommodate the different chemical reactions needed to produce the range of novel medicines being developed by Zeneca.

■ How is it regulated?

All processes on the site are authorised under Integrated Pollution Control (IPC). Because of the complexity of the operations, the site has five separate authorisations under the Environmental Protection Act 1990 - one each for Hibitane and Cetavlon, one for Tenormin, one for the remaining routine processes and a fifth for the development plant.

■ What are the benefits?

The plant employs over 300 people and supports £500 million of Zeneca Pharmaceuticals sales worldwide.

Most of the material manufactured on the site is exported, benefitting the UK's balance of payments.

■ How well has the process performed for the environment?

Working with the Environment Agency, the site has reduced the impact of its operations. For example the amount of effluent discharged has been reduced by nearly 50 percent. This is the result of a number of water-reduction projects.

The amounts of potentially harmful materials discharged to the River Severn have also been reduced. Working closely with the Environment Agency, a study is under way to look at the feasibility of reducing these discharges still further.



ZENECA LTD



These improvements in environmental performance should be seen alongside quality initiatives as important aspects of making pharmaceuticals. Before they can be sold, pharmaceutical products have to be licensed by the drug regulatory authorities. To protect patients and ensure the product's continuing quality and efficacy, the licence includes a very detailed description of the manufacturing route.

Once approved, this route cannot be changed without obtaining a new product licence which can be very difficult and time-consuming. So any improvements in environmental performance have to be achieved by treating emissions from a process rather than treating them at source.

Similarly, because of the strict requirements for purity of material to maintain the product quality, it is not always possible to recycle materials recovered from the process. In this case Zeneca's policy is to find alternative uses for the materials outside the pharmaceutical industry.

Given these restrictions, the future is to develop processes for new products which minimise any impact on the environment. The process development group at Avlon have this as one of their key targets.

Before a new process is selected a number of routes will be considered and assessed. Zeneca has developed criteria which have to be satisfied before a process is operated.

These criteria include ensuring that the materials to be used:

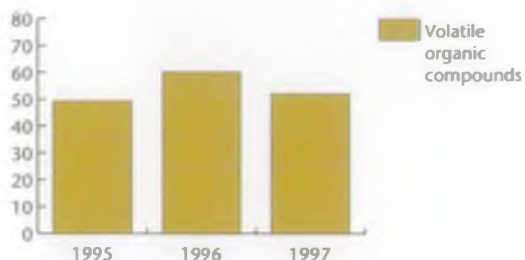
- can be handled safely;
- pose a minimum risk to the environment;
- produce the minimum of waste materials;
- only produce waste that can either be recovered for further use or safely treated before discharge.

■ Conclusion

Chris Topps, Safety, Health and Environment Assurance Manager at the Avlon Works, says: 'Many of our procedures and controls were in place before IPC but having the regulations has provided the site with a clear focus for improving its performance.'

'There have also been clear benefits from inspection by the Environment Agency whose personnel are able to provide additional advice based on experience and a thorough understanding of the processes and operations.'

ZENECA LTD

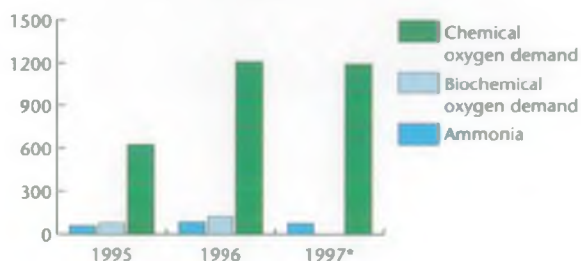


Zeneca – Emissions to air of volatile organic compounds (tonnes)



Zeneca – Discharges to the River Severn (kilograms)

* The mercury discharges were too small to appear on the graph: 1995 0.08kg; 1996 0.363kg; 1997 0.78kg.



Zeneca – Discharges to the River Severn (tonnes)

* The requirement to measure biochemical oxygen demand was removed from Zeneca's authorisation in 1997



THE AGENCY'S VIEWS

The limits authorised for discharges to the River Severn were very difficult for the operator to comply with. During the first four years of authorisation there have been many occasions when the limits were exceeded; all are recorded on the Public Register. The company has worked hard to prevent or minimise these excess discharges and they are now rare.

The nature of the processes makes it difficult to further reduce the amount of oxygen required by the effluent. During 1998, the company committed itself to a programme of expenditure which should lead to a new effluent treatment plant being built within two to three years. This plant will be essential if new processes are to be introduced onto the site.

The 1998 review of the company's authorisations highlighted the continuing VOC emissions to atmosphere from the site. Work has begun on tackling this by undertaking a detailed review of all emission points and agreeing with the company a programme to reduce the amount of VOC in the discharges. In 1997 the Agency expressed its concern over the company's maintenance and inspection policy, following equipment failures which had resulted in discharges to the environment. In response, the company brought forward the implementation of new maintenance and inspection procedures which were being developed.

In December 1997 an Enforcement Notice was served on the company after excessive levels of mercury were discovered in the drainage and effluent systems. The Notice required these systems to be surveyed and cleaned within a short period of time. The company complied and there have been no further problems with mercury.



AVONMOUTH REFUSE DISPOSAL WORKS

■ Introduction

The Avonmouth Refuse Disposal Works (ARDW) stopped operating as a municipal waste incineration process in November 1996. It was unable to achieve revised lower limits for releases to air which came into effect the following month through an EC Directive.

■ What was the process?

The process consisted of two roller grate furnaces. Each furnace could continuously incinerate municipal waste at a rate of 17 tonnes per hour, without energy recovery. Exhaust gases were cooled in quench towers and cleaned in electrostatic precipitators before release to air through a 76-metre chimney.

■ How is it currently regulated?

Avon County Council operated the site during most of its lifetime from the early 1970s. Bristol City Council took over responsibility in April 1996 when local government was reorganised into unitary authorities.

The incineration process is closed and mothballed awaiting decisions on its future. But the site is still used as a Waste Transfer Station. It can receive and compact up to 350 tonnes a day of municipal waste for transfer to a local landfill site.

The waste transfer operation uses the site's compartmental waste reception pits and crane grab. The operation is regulated by the Environment Agency by a waste management licence under Part II of the Environmental Protection Act 1990.

A variation to the licence for the incineration process was granted in March 1997. This allows operation of one furnace but only if fitted with a comprehensive flue gas treatment plant. This would reduce releases to air and meet the new tougher standards set by the variation. The variation notice runs out in March 2001 if operation without energy recovery is adopted.

■ What are the benefits?

The main benefits from the improved incineration process are the reduction in mass, volume and biological potential of incinerator ash, compared to putting raw refuse into landfill.

Now it has the variation, Bristol City Council can include operation of the improved incineration process as an option under its strategy for waste disposal. It does not commit the council to this option but provides the basis for contractors to tender for waste management.

■ Conclusion

The council carried out a major public consultation on the management of Bristol's household waste from September to December 1997. This led to a waste management strategy being adopted by the council in March 1998.

The strategy includes recognition of the role of waste-to-energy. It also recognises the importance of the ARDW site for the development of future options, including the possibility of operating the improved process.

But because this awaits tendering and letting of waste management contracts, it is unlikely that such a process would start operating before the end of 1999, or 2000 at the earliest.

HOW TO GET MORE INFORMATION

Environment Agency

The Agency aims to give the public as much information as possible on our duties, organisation, funding and actions. We provide environmental information as part of our duties under various Acts of Parliament and through the Environmental Information Regulations 1992.

We also provide other information on our decision-making process and funding, as part of the Open Government Initiative 1993. We have a Customer Charter which sets out our standards of service and includes details of our complaints procedure.

We maintain several public registers which you can inspect at our regional or area offices. You can see a register free of charge between 9.30am and 4.30pm on normal working days. Please call before you make a visit to make sure that the information you want is available at your local office.

The office covering Avonmouth is the North Wessex Office at Rivers House, East Quay, Bridgwater TA6 4YS; Tel 01278 457333.

The main public registers include:

- Integrated Pollution Control Register - this holds information on industrial processes we regulate;
- Radioactive Substances Register - this has details on the use, keeping and disposal of radioactive materials;
- Water Quality and Pollution Control Register - this has information on applications to put effluent into watercourses ('discharge consents'), our standards for the quality of water, and maps of defined coastal waters and freshwater limits;
- Waste Management Licence Register - this has information on waste and sites which manage waste.

We also provide:

- an Inventory of Substances and Releases (ISR), which has information on the pollution released from industrial processes we regulate;
- summaries of special waste movements and disposals.

During 1999 the ISR data will be available on the Agency's internet website at: www.environment-agency.gov.uk. This will provide access to the 1998 emissions data for the sites in this guide.

Local authorities

The local authorities keep registers of information about industries in their area. These registers cover various subjects including:

- copies of Part A authorisations issued by the Environment Agency under the Environmental Protection Act 1990;
- Part B authorisations issued by the local authorities under the 1990 Act;
- authorisations under the Planning (Hazardous Substances) Regulations 1992 which regulate the holding of potentially hazardous material.

These registers may be inspected at the offices of:

**Bristol City Council**

Brunei House, St George's Road, Bristol
Tel 0117 922 2000.

Please ring to arrange to see the registers - ask for Health & Environmental Services and speak to a member of the Environmental Protection Group.

**South Gloucestershire Council**

Council Offices, Castle Street, Thornbury,
South Gloucestershire
Tel 01454 868686.

Please ring to arrange to see the registers - ask for Environmental Services and speak to a member of the Pollution Team. Information from the registers will soon be available on the council's website with a summary of general air quality in South Gloucestershire.

SOUTH WEST REGION ADDRESSES

REGIONAL OFFICE

Environment Agency
South West Region
Manley House
Kestrel Way
Exeter EX2 7LQ
Tel: 01392 444 000
Fax: 01392 444 238

NORTH WESSEX

AREA OFFICE
Environment Agency
Rivers House
East Quay
Bridgwater TA6 4YS
Tel: 01278 457 333
Fax: 01278 452 985

DEVON AREA OFFICE

Environment Agency
Exminster House
Miller Way
Exminster
Devon EX6 8AS
Tel: 01392 444 000
Fax: 01392 442 109

CORNWALL AREA OFFICE

Environment Agency
Sir John Moore House
Victoria Square
Bodmin PL31 1EB
Tel: 01208 78301
Fax: 01208 78321

SOUTH WESSEX

AREA OFFICE
Environment Agency
Rivers House
Sunrise Business Park
Higher Shaftesbury Road
Blandford DT11 8ST
Tel: 01258 456 080
Fax: 01258 455 998



Internet World Wide Web

www.environment-agency.gov.uk

For general enquiries please call your local Environment Agency office. If you are unsure who to contact, or which is your local office, please call our general enquiry line.

**ENVIRONMENT AGENCY
GENERAL ENQUIRY LINE**

0645 333 111

The 24-hour emergency hotline number for reporting all environmental incidents relating to air, land and water.

**ENVIRONMENT AGENCY
EMERGENCY HOTLINE**

0800 80 70 60



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