8. Waste management and

Who does what? Who does what?

- The Department of the Environment (DoE)/ Welsh Office (WO) are responsible for formulating policy and providing a legislative framework on environmental issues to be implemented by the Environment Agency and local authorities.

- Ministry of Agriculture, Fisheries and Food (MAFF) licenses disposal of material into the sea. In some cases applicants will also require consent from the Department of Transport.

- The Environment Agency regulates discharges to water, air and land including:
  - discharges of trade or sewage effluent to the estuary;
  - all discharges from major industrial processes defined as Part A under the Integrated Pollution Control regime as set out in the Environmental Protection Act 1990 and associated regulations;
  - most waste management activities on land, including landfill sites;
  - the use and disposal of radioactive materials.

- The Environment Agency monitors water quality in the estuary for compliance with relevant standard EC Directives. Compliance is assessed by the DoE/ WO.

- The Environment Agency, in consultation with MAFF/ WO, has responsibility for regulating waste disposal from nuclear licensed sites.

- MAFF monitors levels of radioactivity in the food chain and the Environment Agency monitors environmental radioactivity levels around licensed sites.

- County and unitary local planning authorities are responsible for controlling non-operational land use aspects of waste management developments, such as the location of landfill sites, through the land use planning system.

- Local authorities control some operational aspects of waste management activities through their environmental health powers.

- Local authorities have waste management duties including waste collection, waste disposal, clearance of highways and litter, including fly-tipping.

- Local authorities' Environmental Health departments are responsible for air quality management and authorise atmospheric discharges from industrial processes defined as Part B as set out in the Environmental Protection Act 1990 and associated regulations.

- Local authorities have responsibilities regarding statutory nuisance, including noise and odours from waste and industrial sites. They also advise on health related issues and recreational water use, and have various responsibilities as port health authorities.

Stated Government aims Stated Government aims

- To protect, maintain and improve the quality of coastal waters.

- To improve air quality, to reduce any significant risk to health, and to achieve the wider objectives of sustainable development in relation to air quality.

- To reduce the amount of waste produced; to make the best use of what waste is produced; and to choose waste management practices which minimise the risks of immediate and future environmental pollution and harm to human health.

- To safeguard human health and protect the marine environment, including fisheries, from any adverse effects of depositing wastes and other materials at sea.

- To minimise interference between those placing materials at sea and others engaged in legitimate exploitation of marine resources or using the sea.

- To prevent the pollution of ground and surface water, or damage to wetlands caused by disposal of waste to land and to protect other uses.

BackgroundBackground

This chapter is divided into two main parts:

- **Waste management;** which describes the various activities in the estuary:
  - sewage disposal
  - industrial discharges to water
  - industrial discharges to air
  - nuclear licensed site discharges
  - solid waste management

- **Environmental quality of the estuary;** which describes:

-. monitoring work
-. water quality
-. air quality
-. radioactivity
-. litter
- waste arisings surveys.

Waste managementWaste management

Sewage effluent disposalSewage effluent disposal

There are 33 consented sewage discharges to the estuary operated by the water service utilities. These are identified on **Map 8.1** and have a combined total volume of 1 million m^3 per day. They are monitored regularly by the Environment Agency to assess compliance with their consent conditions. Over 600 effluent samples are taken each year; sampling frequencies depend on the size of the discharge.

At present the levels of treatment given to these discharges varies around the estuary. Most of D_r Cymru Welsh Water discharges are of untreated sewage and serve the south-east Wales valleys, and the major settlements of Newport, Cardiff, Penarth and Barry. These discharges are made directly to the estuary via outfalls, many at the low water mark, but some of which discharge at or just below the high water mark. In the upper estuary improvements have already been made at Gloucester (Netheridge) Sewage Treatment Works by Severn Trent Water. Other discharges in this area are only partially treated at present. The majority of Wessex Water's discharges receive some treatment, ranging from screening to biological treatment, although the largest single discharge, from Avonmouth, receives primary treatment.

Some of the Wessex Water discharges, which may impact upon European Community (EC) Identified Bathing Waters, are disinfected with chlorine during the bathing waters season to reduce the numbers of sewage bacteria. The Environment Agency and water service utilities are discussing long term plans for disinfection with ultra-violet or membrane technology at all discharges that potentially impact on recreational waters on both sides of the estuary. As part of the 'Green Seas' initiative, D_r Cymru Welsh Water is aiming to improve discharges to achieve guideline standards by 2002.

Many of the larger volume effluents consist of a mixture of domestic and industrial wastes and may therefore contain heavy metals or organic chemicals. Where these have been identified in the effluents, limits have been set in the discharge consents to control the quantities of these substances entering the estuary. (See section on dangerous substances).

In addition to direct discharges, the major rivers entering the estuary also receive discharges of sewage and trade effluents, and potentially contaminated surface water runoff.

The combined effect of all these discharges on the estuary is described in the section on Environmental Quality later in this chapter. Improvement plans are discussed below.

EC Urban Wastewater Treatment Directive (UWWTD) EC Urban Wastewater Treatment Directive (UWWTD)

This directive sets minimum standards for sewage treatment and sewage collection systems. It specifies secondary treatment for all discharges serving populations or equivalent greater than 2,000 to inland waters and estuaries, and greater than 10,000 to coastal waters.

In the Severn Estuary there are 17 schemes where secondary treatment will be installed to meet the main requirements of this directive. There are four other schemes which will also meet the appropriate treatment requirements of the directive as shown in **Table 8.2.** In addition some schemes, for example those of D_r Cymru Welsh Water, will go beyond the Bathing Water Directive standards and aim to achieve the higher guideline standard at designated beaches.

The directive also allows lower standards of treatment for discharges to 'less sensitive' areas. Less sensitive areas or 'High Natural Dispersion Areas are those estuarine or coastal waters which are naturally very turbulent. Dischargers must demonstrate that no harm will be caused to the environment by the lower level of treatment. The Environment Agency is responsible for ensuring that these studies are carried out correctly by the water service utilities.

The Department of the Environment (DoE), in consultation with the Environment Agency, has proposed the area off Watchet as a High Natural Dispersion Area. Wessex Water will be carrying out comprehensive studies to establish whether a lower level of treatment for the discharge at Watchet will cause adverse environmental effects.

Severn Estuary boundary - judicial reviewSevern Estuary boundary - judicial review

The DoE's decision to define the seaward boundary of the Severn Estuary at the old Severn Road Bridge for the purposes of the UWWTD was the subject of a judicial review brought by Bristol City Council and the former Woodspring District Council. The Court upheld the applicants' case because the DoE's decision was made taking into account costs, which was not considered appropriate by the Judge.

Following the Judicial Review, the DoE has decided to draw the seaward limit of the Severn Estuary at a line from Lavernock Point through the Holms to Howe Rock on Brean Down. This decision means that secondary treatment of sewage discharges will be required at Avonmouth and Portbury.

All improvements made to sewage treatment levels throughout the estuary will assist in reducing the amounts of sewage bacteria, sewage derived litter, and to some extent nutrient levels. However riverine sources of litter and nutrients are also significant. These will also be reduced as sewerage improvements are made throughout the river catchments draining into the estuary under UWWTD.

Map 8.1 Major sewage discharges to the estuary

Table 8.2: Planned improvements to sewage treatment for the Severn Estuary

Scheme	Level of treatment	Date	Notes
DCWW Schemes			
Chepstow-Sedbury (Hunger-Pill Outfall)	Secondary	2000	Includes Hunger-Pill Outfall.
Caldicot	Secondary	2002	
Magor Pill	Secondary	2002	
Newport	Secondary	2000	Improvements to meet UWWTD.
Cardiff East (Western Valley, Rhymney Valley, Cardiff Eastern and Cardiff Central Outfalls)	Secondary	2000	DCWW have applied for an extension to the completion date on technical grounds to 2002. Primary treatment will be in place by 2000.
Cardiff West - Lavernock (Cardiff Western, Penarth Marina, Penarth Head, Penarth Kymin, Penarth Lower, Barry East Outfalls)	Secondary	2000	1st phase completed March 1997. Second phase to be completed 1998.
Cardiff West - Barry (Barry West Outfall)	Secondary	2000	Completion due 1998. Proposal include disinfection by 2002.
Llantwit Major	Secondary	2000	Ultraviolet disinfection to be included.
Severn Trent Water			
Blakeney	Secondary	2005	
Lydney	Secondary	2000	Completion due 1998.
Broadoak	Appropriate	2005	
Newnham Macerator	Appropriate	2000	Improvements to meet 'Appropriate Treatment' requirements of Directive.

Table 8.2: Planned improvements to sewage treatment for the Severn Estuary (cont.)

Scheme	Level of treatment	Date	Notes
Wessex Water			
Thornbury	Secondary	2000	Review need for outfall relocation after secondary treatment is operational.
Avonmouth	Secondary	2000	Timing to be agreed with DoE.
Portbury	Secondary	2000	Improvements to meet UWWTD standards.
Aust	Relocate outfall	2005	
Kingston Seymour	Secondary	2000	Improvements to meet UWWTD standards.
Weston-super-Mare	Secondary and Disinfection	2000	Improvements to meet EC BWD and UWWTD requirements.
Minehead	Secondary and Disinfection	2000	Improvements to meet EC BWD and UWWTD requirements.
Watchet	Primary and outfall relocation	2000	Scheme to be finalised.
Doniford	Preliminary	2000	Scheme to be finalised.
Bridgwater	Secondary	2000	Improvements to meet UWWTD standards.
West Huntspill	Secondary	2000	Improvements to meet UWWTD standards.

Industrial discharges to waterIndustrial discharges to water

There are two main areas of industrial discharges: the Newport - Cardiff - Barry area and Avonmouth. The main industries are paper manufacture, steel-making, chemical manufacture and smelting. Disposal of sludge is dealt with in the section on controlled waste management later in this chapter. The major industries with discharges to the estuarine waters are shown on **Map 8.2**.

Most of these discharges are large and take advantage of the high dilution afforded by the estuary or the substantial volumes of water available for cooling. Many of these discharges contain toxic substances, such as heavy metals and organic compounds. Limits are imposed in the consents and authorisations to a level so as to minimise the environmental impacts. These limits also reflect the requirements of the EC Dangerous Substances Directive to ensure Environmental Quality Standards (EQS) are met in the receiving waters. The limits take into consideration the North Sea Conference (Annex 1A) decisions which were the driving force to reduce the input of the more toxic or persistent substances to coastal waters.

Samples are taken by the Environment Agency to monitor these discharges, or to audit sites which self-monitor in accordance with their Integrated Pollution Control authorisations. On occasions, the Environment Agency has had to bring enforcement action through prosecution, but the compliance record of industrial dischargers is generally good.

Discharges also arise from farms, either directly, or diffusely from run-off from surrounding land. Fertilisers and pesticides may be washed into the estuary via the inflowing rivers. Other pollutants may also enter the estuary from contaminated industrial land.

Map 8.2: Major industrial discharges to water

Industrial discharges to airIndustrial discharges to air

The major industrial sites around the estuary discharge waste gases to the atmosphere. These discharges are limited by authorisations from the Environment Agency (part A processes) or by local authorities (part B processes) under the Environmental Protection Act 1990. Authorisations ensure that the production of harmful waste products is prevented or if prevention is not possible, that the releases are minimised or rendered harmless. Each site has a detailed improvement plan aimed at reducing overall environmental impact and the potential for emissions.

Limits for emissions are set primarily using the principles of 'best available techniques not entailing excessive cost' (BATNEEC) while having regard to the 'best practicable environmental option' (BPEO) for the substances which may be released by the process. These limits are usually well below those required by air quality standards. EC Mandatory Environmental Standards for Air Pollutants are used where appropriate. For other pollutants which do not have these EC standards several other guidelines are used: World Health Organisation, Expert Panel on Air Quality Standards, or EC guidelines and recommendations. National Air Quality Strategy standards will apply once these are formalised.

Trans-boundary pollution, together with emissions from vehicles, landfill sites, waste burning, non-prescribed and natural processes also contribute to air pollution on a local scale. There are 47 authorised sites within the plan area as shown on **Map 8.3.**

Nuclear licensed site dischargesNuclear licensed site discharges

There are four nuclear power stations within the plan area at Berkeley, Oldbury and Hinkley Point A and B as shown on **Map 8.3.** These are operated by Magnox Electric plc, except Hinkley Point B which is operated as part of British Energy by Nuclear Electric Ltd. The reactors at Berkeley are presently being decommissioned. The operation of stations is licensed by the Nuclear Installation Inspectorate, part of the Health and Safety Executive.

Discharges of radioactive wastes are regulated under Radioactive Substances Act authorisations by the Environment Agency. Limits are set to protect people living in the locality identified as 'critical groups', which are the most exposed groups of individuals. These groups receive acceptably low doses which are well below doses from naturally occurring background radiation. Where conditions of the authorisation are breached, enforcement action is taken.

Small users of radioactive materials are also regulated by the Environment Agency. These include hospitals, research establishments, and some engineering and manufacturing industries. Where radioactive waste is produced, small amounts may be discharged to sewers or the atmosphere under authorisation. The assessment of radiation doses in the locality as a result of these disposals follows the same approach as that described above.

Map 8.3: Major atmospheric discharges and nuclear licensed site discharges regulated by the Environment Agency.

Controlled waste managementControlled waste management

Controlled waste management will be considered in two ways. The impact of controlled waste disposal to land, either at present or in the past, and the impact of controlled waste disposal to sea and estuarine waters, either legally through licensed disposal at sea or by illegal fly-tipping to rivers, estuaries and disposal from shipping.

Waste management facilitiesWaste management facilities

There are a range of waste management facilities within the plan area which are regulated by the Environment Agency. These can be divided into the following main types:

Licensed waste management sitesLicensed waste management sites

There are over 60 waste disposal sites within the plan area. Most of these are relatively small landfill, storage, transfer and treatment facilities. Major sites discharging to the estuary are shown on **Map 8.2.** Examples include landfills at Sudmeadow, Gloucester; Lamby Way, Cardiff, Maesglas, Newport, Walpole Drove, between Burnham and Bridgwater, and Harnhill, Olveston. Examples of other facilities include a large chemical treatment plant in Newport, a solvent and oil recovery plant at Avonmouth and a clinical waste incinerator at Avonmouth.

Exempt facilitiesExempt facilities

These sites cover a wide range of activities, such as spreading waste on land for agricultural benefit, deposits of specific volumes of inert wastes for permitted development, storage and processing of specific volumes of recyclable wastes and certain scrap metal facilities. These sites do not need a waste management licence provided they meet environmental guidelines.

Illegal waste management activitiesIllegal waste management activities

Illegal waste management usually involves illegal tipping of material. This can vary from one-off fly-tipping of household waste to large scale dumping of commercial and industrial wastes. Fly-tipping occurs at many sites around the estuary such as Aust and the Gwent Levels. In the upper estuary landowners sometimes try to stabilise the river banks without permission using large rocks. Local authorities have duties as waste collection authorities to clear highways and verges of fly-tipped material. Detection and prosecution of fly-tipping is carried out by the Environment Agency and local authorities, who often work together to secure prosecution.

Contaminated landContaminated land

The former importance of South-East Wales within the industrial development of the western world has left large areas of derelict and abandoned industrial land. Former disposal sites at Ferry Road, Cardiff, Penarth Head and Rhoose Point have been or may be subject to major reclamation schemes. Similarly in the Avonmouth area, zinc and other non-ferrous metal smelting has taken place for the past hundred years. Historically, the slag, which is contaminated by metals, especially zinc, lead and cadmium, was seen as an asset and widely used for raising land levels in areas prone to flooding or below sea

level. Another site known to be contaminated is British Gas land off Bristol Road, Gloucester which is due for redevelopment.

Past domestic and industrial landfill sites were operated on a 'dilute and disperse' principle and the areas around and within these former sites may still be contaminated by leachate and residual fill material from previous disposal activities. Any redevelopment of such sites may release residual leachate and expose fill material to rainfall, significantly increasing the potential for contamination of both groundwater and surface water. This can present potential pollution problems, mainly because of ground contamination as a result of previous activities that may have occurred over a long period of time.

Large areas of former industrial land around the estuary are being regenerated. Redevelopment plans for these areas have required extensive ground contamination surveys to quantify the extent and type of contamination. In many cases, Environmental Assessments have been undertaken to quantify the degree of risk posed by the redevelopment and to propose remediation measures to overcome the potential risk.

Sludge disposal to landSludge disposal to land

The disposal of sewage sludge and industrial sludge to agricultural land is an increasing practice. This is regulated by the Environment Agency to avoid potential groundwater and surface water contamination, or damage to wetlands. An EC Directive on protection of the environment, in particular the soil when sewage sludge is used in agriculture, provides guidance on this.

Around the estuary there are two main areas where land spreading is undertaken: the Gwent levels to the east of Newport, and the coastal belt south of the A48 in the Vale of Glamorgan. In these locations three main types of waste are spread: sewage sludge, paper industry waste and biological effluent treatment plant waste. These materials are spread to enhance the quality of the soil for agricultural purposes. Providing spreading takes place at suitable locations, and according to best practice, then it is considered that there is unlikely to be an adverse environmental impact, although there is the potential for detriment to the amenity for local residents and visitors using the area for recreation.

Farm slurry is spread onto land in accordance with the MAFF Code of Good Agricultural Practice. Nitrate levels rise in the Severn catchment during winter and this is considered to be from farm runoff. Nitrate levels in the Severn at Gloucester do not exceed the Drinking Water Directive standard of 50 mg/l but sometimes exceed the standard for a limited time in the Gloucester Sharpness Canal water which is abstracted at Purton for Bristol's drinking water supply. As a consequence the canal catchment is being considered as a candidate for Sensitive Area status under the Urban Waste Water Treatment Directive (UWWTD). This will enable measures to be put in place to protect the water supply .

Disposal at seaDisposal at sea

Sludges from the treatment of sewage and industrial waste were previously disposed of at sea but under the OSPAR Convention (1992) disposal at sea will be limited to dredged material. Applications for disposal of sewage and industrial sludges at sea will not be permitted where a safe and practical method for dealing with the waste on land is

available. The Urban Waste Water Treatment Directive also requires the phasing out of disposal of sludge from sewage works by the end of 1998, such disposal has already stopped in the Severn Estuary.

See chapter 7 for further information on disposal of dredgings.

Environmental quality of the estuaryEnvironmental quality of the estuary

Monitoring Monitoring

The Environment Agency monitors water quality in the estuary and takes over 1000 samples each year from 102 sites. Of these, over 800 samples are taken at 59 sites to measure background levels of contaminants within the estuary against European Community (EC) Directive standards and other international agreements. The monitoring sites are shown on **Map 8.4**.

Additional monitoring of the estuary is carried out by the Environment Agency's National Centre for Marine Surveillance. Forty-three sites are sampled by helicopter six times a year. The programmes are regularly reviewed to ensure that adequate, cost effective monitoring is carried out. Bacterial numbers, sediments and biota (mussels and seaweed) at some sites are also monitored. Mussels and seaweed take up certain metals and organic compounds from seawater and concentrate these substances within their tissues. This process is known as bio-accumulation. Analysis of mussel tissue and/ or seaweed gives an indication of contaminants present in seawater. The Environment Agency monitors the quality of mussel tissue at two sites in the estuary and the quality of seaweed tissue at seven sites.

Water quality in the estuary

Bacterial quality of bathing water

Numbers of sewage bacteria are monitored at thirteen EC Identified Bathing Waters, nine other 'non-identified' beaches, and twenty-five mid-channel sites. Of these, six of the EC waters have failed to meet the standards, in at least one of the last five years, as have six of the non-identified waters. The EC Identified Waters which have failed are Barry - Jackson's Bay, Barry - Whitmore Bay, Clevedon, Sand Bay, Weston Main and Weston Uphill.

Relatively low numbers of sewage bacteria are found in the mid-channel of the outer and middle estuary, but numbers increase from Chepstow to Gloucester.

EC Dangerous Substances DirectiveEC Dangerous Substances Directive

The EC Directive on Dangerous Substances protects the water environment by controlling discharges that contain substances harmful to rivers, estuaries and coastal waters. This directive describes two lists of compounds. List 1 contains substances regarded as particularly dangerous because they are toxic, they persist in the environment and they bio-accumulate. Discharges containing List 1 substances are controlled by Environmental Quality Standards (EQSs) issued through later Directives. List 2 contains substances which are considered to be less dangerous but which can still have a harmful

effect on the water environment. Discharges of List 2 substances are controlled by EQSs set by the individual Member States.

The Environment Agency is responsible for authorizing, limiting and monitoring dangerous substances in discharges. It is also responsible for monitoring the quality of waters which receive discharges containing dangerous substances and reporting the results to DoE who decide whether the standards in the directive have been met. Where the requirements of this directive have not been met, the Agency is responsible for identifying sources of pollution and making sure that improvements are made.

Map 8.4 : Water quality and Environment Agency monitoring sites

Compliance with the Directive is determined by comparing the annual average concentration for each contaminant monitored in the estuary with the relevant EQS. Over the last three years all sites associated with discharges in the estuary have been within the EQS.

North Sea Conference Annex 1A Reduction ProgrammeNorth Sea Conference Annex 1A Reduction Programme

In addition to EC Directives, there are other international agreements made at North Sea Conferences which aim to reduce levels of harmful substances, such as the North Sea Conference Annex 1A Reduction Programme. The Environment Agency monitors quantities of North Sea Conference Annex 1A substances entering the estuary.

The large volumes of industrial effluent and several major rivers have contributed significant quantities of trace metals, and the organic solvents, chloroform and tetrachloromethane, to the estuary. In addition, contaminated land within a chemical manufacturing site, has also been a source of significant loadings of polychlorinated biphenyls (PCBs).

Through co-operation between major dischargers and the regulators, and subsequent investment by dischargers, substantial reductions have been made in the quantities of mercury, cadmium, zinc, chloroform and tetrachloromethane derived from major industrial areas, as well as in the loadings of PCBs from Newport area.

Environment Agency monitoring has shown significant loadings of arsenic entering the estuary from the Avonmouth area. However, monitoring under the EC Dangerous Substances Directive has shown that the EQS for arsenic in the estuary has been met.

The Environment Agency will continue to monitor the quantities of North Sea Conference Annex 1A substances entering the estuary from significant riverine sources and discharges. It will seek to ensure that the reductions achieved to date are sustained.

General water qualityGeneral water quality

The Environment Agency uses the National Water Council (NWC) Estuary Classification Scheme to provide a simple, subjective assessment for estuaries based on biological, chemical and aesthetic quality. The classification is as follows:

A Good **B** Fair **C** Poor **D** Bad

The Severn Estuary is divided into eleven reaches for National Water Council Classification purposes, from Gloucester to Lavernock Point/ Parrett Estuary. These are shown on **Map 8.4**. The most recent classifications (1995) are class A (3 reaches) and class B (8 reaches). These have not changed since 1990 except for the two reaches below Gloucester (Netheridge) Sewage Treatment Works to Epney which have improved from C to B following a major improvement scheme at the works.

NutrientsNutrients

Nitrate and phosphate levels throughout the estuary have exceeded the standards required by the Urban Waste Water Treatment Directive over the past six years. However, high

levels of suspended solids, due to the large tidal range, limit the amount of light penetration so that algae cannot grow to levels which would cause nuisance. Throughout the lower estuary, chlorophyll levels have almost always been below the standard indicative of eutrophication. In the middle to upper estuary, where the turbidity is less, algae do grow to give high levels of chlorophyll during summer months, but there is little visual evidence of blooms and no evidence of harmful impacts on other aquatic life. For these reasons it has not been considered for designation as a eutrophic sensitive area under the UWWTD.

Heavy metalsHeavy metals

The level of dissolved copper in the water of the estuary has been around the Environmental Quality Standard (EQS) of 5 micro grams per litre annual average throughout the last six years. Copper enters the estuary from many sources, but the specific source of the high levels is not known. All other heavy metals (mercury, cadmium, lead, zinc, arsenic and chromium) were well below their respective EQS values at all sites throughout the monitoring period.

Metal levels within estuarine sediments have remained at a similar level to those reported in the mid seventies and early eighties apart from cadmium which has declined markedly. Compared to other industrialised estuaries such as the Clyde and the Mersey, the Severn has lower sediment metals concentrations.

Over time there has been a decline in some metals (copper, zinc, cadmium and lead) within the Severn Estuary biota. Compared to other Welsh industrialised estuaries such as the Dee, the highest levels of copper, zinc, cadmium and nickel are found within the Severn. Compared to other UK sites, such as the metalliferous mining areas of South West England, concentrations of metals in the biota are lower, apart from cadmium. The highest UK levels of cadmium were found in biota from the Severn in the late seventies and mid eighties but levels have now declined markedly.

Organic chemicalsOrganic chemicals

A number of trace organic chemicals were recorded in the water samples throughout the monitoring period. Chloroform, carbon tetrachloride, gamma HCH, atrazine and simazine were the most frequently recorded. The significance of these is unknown but the frequency of the detection does concern the Environment Agency. Most were below the respective Environmental Quality Standard values but some of these chemicals, such as endrin, were observed to exceed the standard. Endrin is an extremely persistent organochlorine insecticide with a high acute toxicity, and has been banned from use since 1984. If endrin is found in water samples today it is mostly likely to be derived from soil leachate. It is anticipated that environmental concentration of endrin will gradually decrease over the years.

PCBs are occasionally detected in low concentrations in the water column, but at high concentrations in sediments at sites in the middle estuary. The manufacture of PCBs was banned in the UK in 1977, but their widespread use and persistence has meant that they are found ubiquitously in the environment at background levels. Unusually, there is, however, still a point source discharge to the estuary from the former main UK manufacturing plant. Although production at this site stopped almost 20 years ago, PCBs still enter the estuary from contaminated groundwater on the site. The company

concerned has invested heavily to reduce their point source input under the North Sea Conference Annex 1A Reduction Programme. The site is now regulated by the Environment Agency through an IPC authorisation which includes an improvement programme and will require further and continued improvements to the effluent handling system and the quality of the effluent discharge.

Trace organic chemicals are almost always below the limits of detection in the biota. It would appear that unlike the sediments, the biota are uncontaminated by organic chemicals.

Air quality over the estuaryAir quality over the estuary

Air quality within the plan area is monitored routinely at only three sites: Cardiff, Gloucester and Bristol. Ambient quality will depend on weather conditions and local discharges to the atmosphere. Under some conditions, emissions do not disperse and can cause locally poor air quality.

Studies in the late eighties by predecessors of the Environment Agency have shown that atmospheric deposition from industrial sites around the estuary are significant inputs to the estuarine waters. It was found that 50% of the lead and zinc inputs and 10-20% of cadmium, copper and nickel came from the atmosphere, but only a small proportion of the chromium, iron and manganese was derived from this source. Most of the cadmium, copper and lead came from the lower atmosphere near Avonmouth and Cardiff Bay.

These studies showed a decline in inputs compared to the early eighties, and it is likely that recent improvements in emissions under Environmental Protection Act 1990 authorisations will have furthered this decline.

Radioactivity in the estuaryRadioactivity in the estuary

Levels of radioactivity in the environment and food are monitored and reported by MAFF. The latest reports are 'Radioactivity in Coastal and Surface Waters of the British Isles 1994' and 'Terrestrial Monitoring Programme Report for 1994'. Environment Agency compliance records are available for individual sites. Local authority environment radiation monitoring programmes also record levels of radioactivity in the estuary.

Waste arisingsWaste arisings

The Environment Agency has a statutory duty to undertake a survey of waste produced by industry, households etc. to contribute to the development of a statutory National Waste Strategy. A pilot survey started in February 1997 and a National Waste Arising Survey is likely to start in September 1997. At present there are limited statistics on waste volumes and types available specifically for the plan area. Existing data is available for wider areas incorporating the plan area, but it is not possible to break these figures down to the plan area.

LitterLitter

The large tidal range of the estuary means that litter is carried for long distances and is deposited extensively over the banks and saltmarshes. It is therefore difficult to pinpoint

the exact quantities and sources of litter. However, a recent national survey by the Marine Conservation Society found that the three main sources of coastal litter were: tourism and recreation, ships and sewage. It is not known exactly what the sources of litter are in the Severn Estuary.

In addition to the coastal sources of litter, the estuary receives litter from its rivers which have travelled through urban and industrial areas carrying litter from land-based sources to the estuary.

Litter deposited on the shores may be contaminated by hazardous substances, and also pose a threat to wildlife through injury and entrapment, as well as being unsightly. When litter is being removed, care must be taken to protect naturally occurring debris as this can be important for some forms of wildlife.

Issues Issues

Many issues in this report are related to one another. Issues raised in this chapter have particular links with those in chapters 3, 4, 6, 9, 10, 11, 12, and 15.

PUBLIC CONCERN ABOUT POLLUTION AND ITS VISUAL EFFECTSPUBLIC CONCERN ABOUT POLLUTION AND ITS VISUAL EFFECTS

W1 General LitterW1 General Litter

Litter on beaches and the shore is an important concern to many people who use the estuary. Many people believe that litter indicates poor quality water and are therefore concerned about entering the water and using the beach. Sources of litter are diverse and can be very distant. The main sources of litter are recreational users, shipping and sewage.

Who is involved: Local authorities, Environment Agency, landowners, shipping companies, Keep Wales Tidy, Tidy Britain Campaign, Sustainable Wales, fishermen, anglers and the public.

What is happening: Local authorities and the Environment Agency are working together to detect and prosecute illegal fly-tipping activities.

Some suggestions: The development of a National Strategy on Litter has been suggested, with participation of all the interested parties, including DoE. Policy could recognise more clearly the principle of care 'from source to the sea'. Consideration could be given to establishing a working group/ forum to co-ordinate the responses of the responsible authorities to try to tackle litter entering the watercourses on a regional basis. Education could be used to raise public awareness to reduce amounts of litter entering the rivers and seas, and direct littering of beaches.

W2 Sewage debris on beaches, foreshores and moorings W2 Sewage debris on beaches, foreshores and moorings

Whilst sewage debris is not the most common form of litter on beaches, foreshores and boat moorings it causes great public concern, and affects people's enjoyment of the

estuary as a recreation area and a tourism destination. The debris enters the estuary from sewage discharges and combined sewer overflows around the coast, and also rivers.

Who is involved: Severn Trent Water, D_r Cymru Welsh Water, Wessex Water and some small private dischargers. 'Green Seas' initiative partners in Wales.

What is happening: Many of the large untreated discharges on the northern side are programmed by D_r Cymru Welsh Water for full treatment by 2000 (see **Table 8.2**) The majority of discharges in the upper estuary and southern side are already screened. Improvements to inland combined sewer discharges are being carried out by all water service utilities with the worst discharges being improved as a priority. Sewage discharges covered by the Urban Waste Water Treatment Directive will be treated by the year 2005.

A 'Green Seas' initiative co-ordinated by the Wales Tourist Board and a wide range of organisations having an interest in improving the coastal environment throughout Wales was launched in May 1996. One of its objectives is to achieve increased and better co-ordinated practical action to improve the quality of the coastal environment.

Some suggestions: Wider public awareness through education such as the 'Bag it and Bin it Campaign' could help to reduce the amount of litter entering the sewerage network.

See also suggestions for general litter, issue W1.

W3 Visual effects of untreated and partially treated sewage dischargesW3 Visual effects

Untreated and partially treated sewage is discharged at five points into the upper estuary, as shown on **Map 8.1**. Some of these outfalls are exposed at low tides and the plume of sewage entering the estuary can be seen. People are concerned as these visible discharges affect their enjoyment of the estuary as a recreation area and a tourism destination. This problem may also be more widely applied to other discharges in the estuary.

Who is involved: Severn Trent Water, D_r Cymru Welsh Water , Wessex Water and private dischargers.

What is happening: Improvements are planned within the water service utilities' investment programmes as identified in **Table 8.2**.

See also the issue on sewage litter (W2), as reduction in litter will reduce the visible impact of these discharges.

W4 Visible oil pollution from contaminated surface water runoffW4 Visible oil pollution from contaminated surface water runoff

In some parts of the estuary, surface films of oil form where runoff from roads and car parks enters the water. These may also be caused by spillages from boats, and are most obvious in harbours where wave action is not usually sufficient to disperse the oil. Rivers, and industrial and sewage discharges may also contain oil, which give rise to public concern.

Who is involved: Environment Agency, site operators.

What is happening: The Environment Agency has an 'Oil Care Campaign' to encourage good practice. The Agency enforces controls on some discharges of surface water. The Agency is seeking to improve site management at Hinkley Point Power station to lower the risk of accidental discharges of oil.

Some suggestions: Further promotion of the 'Oil Care Campaign' could be considered.

PUBLIC CONCERN ABOUT POLLUTION AND ITS EFFECTS ON PUBLIC HEALTH AND HUMAN ACTIVITIESPUBLIC CONCERN ABOUT POLLUTION AND ITS EFFECTS ON PUBLIC HEALTH AND HUMAN ACTIVITIES

W5 EC Directive failures at identified bathing waterW5 EC Directive failures at identified bathing waters

There are six bathing waters in the estuary which have failed to comply with the mandatory limits of the EC Bathing Waters Directive in one or more season in the last five years. The causes of non-compliance on the Welsh side of the estuary, at Barry - Jacksons Bay and Barry - Whitmore Bay, are known. There are many sources of bacterial contamination which may contribute to bathing water failures at Clevedon, Sand Bay, Weston Main, and Weston Uphill. In addition, the bathing water at Minehead may be contaminated by discharges to the Minehead Park stream.

Who is involved: D_r Cymru Welsh Water, Wessex Water, Environment Agency, Somerset County Council.

What is happening: The discharges causing failures at Barry are due to be addressed by D_r Cymru Welsh Water by December 1997. The Environment Agency will continue to investigate reasons for failures on the Wessex coast. Illegal sewage discharges to the Minehead Park stream will be traced by Somerset County Council, and diverted to foul sewer to protect Minehead bathing water. As a long term solution Wessex Water will be replacing chlorination disinfection with other methods such as ultraviolet or membrane disinfection. Proposals have also been put forward by D_r Cymru Welsh Water to disinfect the discharge at Barry after 2002, and D_r Cymru Welsh Water are proposing to achieve guideline standards under the 'Green Seas' initiative.

W6 Monitoring of other bathing waters.

In addition to the identified EC Bathing Waters, monitoring is also carried out at nine popular, 'non-identified' bathing waters in the Severn Estuary by local authorities. Of the nine sites, six were lower than the standards of the Bathing Waters Directive in one or more years although there is no statutory need for them to comply since they are not covered by the directive. These sites reflect the areas of the estuary where the EC identified bathing waters have failed the standards, the reasons for failure are the same as for those given in issue W5.

Who is involved: Local authorities, Environment Agency, Wessex Water, D_r Cymru Welsh Water.

What is happening: There is no statutory need to achieve compliance at these sites, however, it is expected that work aimed at improving quality at the EC identified waters will also result in improvements at non-identified sites.

W7 Sailors concern about mid-channel microbiological quality

Sailors and water sports enthusiasts are concerned about sewage bacteria in the estuary beyond the bathing beaches. The Environment Agency undertakes some limited survey work in the channel. Data from surveys in the last five years indicate relatively low concentrations of sewage bacteria in the outer and middle estuary. However from Chepstow to Gloucester bacterial numbers increase.

Who is involved: Environment Agency, water service utilities.

What is happening: Continued improvements to sewage discharges around the estuary will ultimately lead to reductions in sewage derived bacteria.

W8 Pollution risk to Gloucester - Sharpness Canal drinking water supply to Bristol

The canal is an important abstraction for Bristol Waterworks at Purton and is also used for industrial abstraction, navigation and amenity purposes. It is fed by the Rivers Cam, Frome and other streams and is supplemented from the River Severn at Gloucester Docks in summer.

There is a pollution risk primarily from industry at Gloucester, Stroud and Cam. Oil is the most common pollutant, whilst clean up of the canal requires co-operation and assistance of the navigation authority. There is also a risk of salt water reaching the abstraction at Gloucester during high tides and low river flows (see Chapter 10).

Agricultural pollution is largely from seasonal usage of pesticides within the Severn and canal catchments. Although pesticide levels do not exceed Water Supply Regulations the concentrations can occasionally reach levels of concern. In winter, nitrate levels in the canal can exceed the 50 mg/l drinking water supply standard. The canal catchment is a candidate for sensitive area status under the Urban Waste Water Treatment Directive (UWWTD).

Who is involved: Environment Agency, industry and agricultural bodies, British Waterways, Bristol Water.

What is happening: The Environment Agency will continue routine sampling and remote monitoring stations are being installed as early warning stations. The Environment Agency also has an ongoing programme of pollution prevention site inspections at industrial sites along the canal. Bristol Water carefully monitor their intake to ensure that the water they supply meets required standards.

Some suggestions: Consideration could be given to designation of the canal as Sensitive Water under the terms of the UWWTD.

W9 Radioactive discharges from nuclear licensed sites

There are four nuclear power stations around the estuary: Berkeley, Oldbury and Hinkley A and B. The discharges of radioactive waste from these sites are regulated by the Environment Agency under authorisations issued under the Radioactive Substances Act 1993. The radioactive discharges are monitored by the operators with appropriate check monitoring by the Environment Agency. These have remained within the limits imposed.

Who is involved: Environment Agency, Nuclear Installations Inspectorate, Nuclear Electric Ltd and Magnox Electric plc.

What is happening: The Environment Agency monitors and enforces Radioactive Substances authorisations. Authorisations will be reviewed every four years and ongoing improvement plans will be used to minimise discharges. Decommissioning of Berkeley power station is underway following its closure several years ago.

W10 Atmospheric discharges from industry

Many major industrial developments are sited around the estuary which discharge some waste gases to the atmosphere. Numerous public complaints are received about the effect these discharges may be having on people's health, as will the effect of odour and any visual intrusion. Major 'part A' sites are regulated by the Environment Agency, smaller 'part B' processes are regulated by local authorities. Emissions from vehicles and certain weather conditions can aggravate the problem. Discharges from outside the area may also have an impact.

Who is involved: Environment Agency, local authorities, English Nature, Countryside Council for Wales, industry.

What is happening: The Environment Agency monitors and enforces authorisations. Authorisations will be reviewed every four years and ongoing improvement plans will be used to minimise discharges. Local authorities monitor and enforce their controls on industry.

Some suggestions: It is anticipated that implementation of the National Air Quality Strategy and its standards, and monitoring against these, will enable the true extent of the problems to be accurately assessed and resolved.

PUBLIC CONCERN ABOUT POLLUTION AND ITS EFFECTS ON ENVIRONMENTAL QUALITY

W11 Nutrient levelsW11 W11 Nutrient levels

Discharges from sewage works and runoff from agriculture have contributed to high nitrate and phosphate levels throughout the estuary. At present the high turbidity inhibits the growth of algal blooms to avoid causing nuisance problems. However, there may be concern where turbidity is reduced following impoundment by barrage construction, for example in Cardiff Bay. In addition, nutrients may be contributing to algal blooms in the Bristol Channel.

Who is involved: Environment Agency, water service utilities, Cardiff Bay Development Corporation.

What is happening: Within Cardiff Bay, negotiations are ongoing between the Environment Agency and Cardiff Bay Development Corporation on the management of the impoundment. Cardiff Bay Development Corporation will remove algal and weed accumulations as necessary after 1998, until the corporation winds up in 1999. Management of the impoundment after this is still to be determined.

W12 Pesticide levelsW12 W12 Pesticide levels

See issue R5 in chapter 4.

W13 Thermal pollutionW13 W13 Thermal pollution

The estuary is used as a source of cooling water for power stations and other large industries. Large volumes of water are returned to the estuary above ambient temperature. These show as plumes of warm water when detected using remote thermal imaging. In some cases the impact has been investigated by the dischargers, but more comprehensive studies would be needed to verify that no detrimental effects were occurring.

Who is involved: Environment Agency, major dischargers of heated cooling waters, English Nature, Countryside Council for Wales.

What is happening: The Environment Agency and dischargers have undertaken some investigations of thermal plumes.

Some suggestions: The Environment Agency could consider undertaking further surveys in consultation with dischargers and conservation agencies to establish the extent of thermal plumes and their ecological impact. The results could be used to set appropriate temperature consent limits on the discharges.

W14 Heavy metalsW14 Heavy metals

In general, monitoring by the Environment Agency has shown levels of metals included in the Dangerous Substances Directive comply with their Environmental Quality Standards (EQS). Copper levels are close to the EQS at a number of sites around the estuary.

Metals do remain bound up in the sediments for long periods and levels have changed little in the last twenty years despite reductions in the levels actually within the water. However, levels in the Severn Estuary sediments are low when compared with other industrial estuaries such as the Clyde and Mersey. Levels of cadmium have declined significantly in sediments.

The animal and plant life within the estuary still accumulates metals at some locations. Levels are higher in the Severn than other Welsh estuaries, but low compared with other UK sites, except for cadmium.

Particular concerns to the Environment Agency are in Avonmouth, specifically Kingsweston Rhine. One discharge to the rhine has indicated a steady increase in arsenic loading in the period 1992 to 1994. To satisfy the North Sea Conference Annex 1A load reduction commitment, the company concerned is actively exploring all sources of the arsenic contamination on site.

Who is involved: Industry, Environment Agency

What is happening: The Environment Agency monitors and investigates EQS failures as required. The Environment Agency and industry limit the amounts of heavy metals discharged under the terms of the Dangerous Substances Directive and North Sea Conference Annex 1A Reduction Programme.

The Environment Agency monitors the loading of arsenic from the site mentioned previously. The company concerned is investigating sources of arsenic and reducing emissions to satisfy the Government's reduction targets.

The Environment Agency is intending to carry out extensive chemical and biological investigations in areas of concern, to identify the range of substances present and their impact on the local environment. The Environment Agency will carry out site inspections to identify and control illegal discharges and provide pollution prevention advice.

W15 Organic chemicals, polychlorinated biphenyls (PCBs)

Organic compounds enter the estuary from industrial discharges, and also from rivers and sewage discharges. There is concern that levels of these compounds are high, but it is only rarely that EQS levels are exceeded.

There are elevated levels of PCBs in the estuary due to a discharge from the UK's former main PCB manufacturing plant. Although production at this site stopped almost 20 years ago, PCBs still enter the estuary from contaminated groundwater on the site.

Who is involved: Environment Agency, water service utilities, industry.

What is happening: The Environment Agency undertakes monitoring, and investigates EQS failures. The Environment Agency enforces consents, and works with industrial dischargers to reduce levels of organic compounds in effluents under EC Dangerous Substances and North Sea Conference Annex 1A reduction programmes.

The company with the PCB source has invested heavily to reduce the input as part of the North Sea Conference Annex 1A Reduction Programme. The site is now regulated by the Environment Agency through an IPC authorisation which includes an improvement programme and will require further and continued improvements to the effluent handling system and the quality of the effluent discharge.

W16 Pollution from contaminated land

A number of sites around the estuary have historically been used for industry. Spoil tips, leakages and tipping of waste to raise land levels have left land contaminated, often to an unknown extent. Contamination can lead to pollution of groundwater or surface waters, either as an ongoing problem, or when sites are reclaimed for new developments. Some known contaminated land problems are PCBs at a site near Newport, a range of contaminants at Avonmouth, and an old coal gas works in Gloucester.

Who is involved: Environment Agency, local authorities, landowners, developers.

What is happening: Methods for remediation of contaminated land problems need to be considered case-by-case. Strategies to address the problems at particular sites are being developed.

W17 Pollution from land based waste disposal

There are several major landfill sites located around the estuary which discharge leachate. Tide locking of drainage ditches and high water table levels exacerbate the problems of controlling the leachates.

Who is involved: Environment Agency, site operators, local authorities.

Some suggestions: Consideration could be given to installing improved leachate management systems involving new options to dispose of leachate to either the foul water sewer or via an on-site treatment plants into the estuary.

PUBLIC CONCERN ABOUT POLLUTION MANAGEMENT

W18 Public concern at the level of Environmental Quality StandardsW18 Public concern at the level of Environmental Quality Standards

There is public concern that the levels of standards for harmful substances which are set to protect the environment do not give adequate protection.

Environmental Quality Standards (EQS) are set by the appropriate body, such as the EC or Department of the Environment using the best scientific knowledge available at the time. Standards are periodically reviewed as new data become available, and are being set for new substances, using advice from the relevant environmental and scientific organisations.

Who is involved: Department of the Environment, European Community

What is happening: The Environment Agency makes recommendations on appropriate EQSs to the DoE as new information becomes available through research. The DoE and The Environment Agency are advised by appropriate experts and undertakes considerable research on EQSs. The Agency's Environmental Toxicity Advisory Group provides advice and recommends tentative standards for substances which currently have no EQSs but require consenting. The Agency has introduced Direct Toxicity Assessment to control complex discharges containing a number of substances, for which there are no EQSs, by including a toxicity based criterion in the consent.

W19 Public concern over levels of substances permitted in consented discharges

The estuary has always been used as a convenient route for the disposal of liquid wastes. Historically, such discharges were not subject to rigorous control, but all are now consented or authorised by the Environment Agency. There is public concern that the levels of these discharges are too high.

Who is involved: Environment Agency

What is happening: The Environment Agency reviews consents for discharges to the estuary, and liaises with industry to reduce discharges of substances under the Dangerous Substances Directives, Habitats Directive and North Sea Conference Annex 1A reduction programmes.

The Environment Agency considers discharges from authorised sites using the principles of Best Practical Environmental Option (BPEO) and Best Available Techniques Not Entailing Excessive Costs (BATNEEC) and individual site improvement plans to reduce the levels of discharges. The environmental impact of such discharges will continue to be assessed, and any changes acted upon.

W20 Public concern about monitoring and enforcement of consented discharges

Discharges are monitored by the Environment Agency to ensure that they comply with their consents. There is public concern that this monitoring is not adequate, and that companies which fail to meet consent conditions are not penalised.

Who is involved: Environment Agency**.**

What is happening: Environment Agency monitoring data is made available on public registers. The Environment Agency regularly reviews monitoring programmes to ensure monitoring and enforcement levels are maintained.

Some suggestions: The Environment Agency could further publicise the availability of compliance data, and also of any enforcement action taken.

PUBLIC CONCERN ABOUT POLLUTION FROM MAJOR ACCIDENTS

W21 Pollution from oil tankers and oil terminals

The Sea Empress Oil Disaster in February 1996, when an oil tanker ran aground at the mouth of Milford Haven, has raised many issues concerning the emergency plans to deal with such accidents. Accidents can occur during movement of vessels within the estuary, and also during loading and unloading operations.

Who is involved: Marine Pollution Control Unit, Department of Transport (Marine Safety Agency), Environment Agency, local authorities, conservation agencies.

What is happening: Recommendations of inquiries into marine accidents are used to formulate appropriate legislation, such as the Merchant Shipping and Maritime Security Bill. The Department of Transport, Environment Agency and other regulatory bodies take appropriate prosecution procedures in the event of such accidents. Procedures such as the Severn Estuary Oil Pollution Plan to be reviewed in the light of recent experiences.

Some suggestions: Consideration could be given to further integrating marine pollution counter measures.

W22 Major accidents at nuclear installations

The presence of four nuclear power stations close to the estuary causes some public concern at the possibility of a major nuclear accident.

Who is involved: Nuclear Electric Ltd, Magnox Electric plc, Health and Safety Executive, local authorities.

What is happening: The stations are licensed by the Nuclear Installations Inspectorate under the Health and Safety Executive. The licensing procedure includes detailed consideration of the design, operation and maintenance of the power stations to ensure that the risks of accidents are acceptably low. The procedure also involves drawing up detailed emergency plans to cover all eventualities such as plant failures, terrorist attacks and major accidents.

W23 Accidents at major industrial sites

Recent events at Albright & Wilson, Avonmouth, Aberthaw Power Station and other large industrial complexes through the country have increased public anxiety at the potential for catastrophic releases from such sites. The Environment Agency regulate site management procedures so that the Best Available Techniques Not Entailing Excessive

Costs (BATNEEC) are used to limit discharges to the environment. In addition many such sites are designated as 'Control of Industrial Major Accident Hazards' sites, and as such have detailed emergency plans in the event of accidents or plant failures. This aspect is regulated by Health and Safety Executive. Off site emergency plans are put in place by local authorities.

Who is involved: Health & Safety Executive, Environment Agency, local authorities.

What is happening: The Environment Agency takes appropriate enforcement action when breaches in site management procedures which could cause accidents occur.

IMPLEMENTATION OF WASTE REDUCTION INITIATIVES

W24 Achievement of waste strategy targets

There is a Government Strategy for the sustainable management of waste, 'Making Waste Work', which sets targets for local authorities, industry and the Environment Agency to reduce, reuse and recycle wastes. This strategy needs to be implemented on a local scale.

Who is involved: Local authorities, waste producers, Environment Agency, Department of the Environment and the Welsh Office.

What is happening: A waste minimisation initiative, SABINA (SustAinable Business IN Action) was recently launched which focuses on the Severn Estuary. This is a pilot scheme funded by the Welsh Office and business sponsors and will initially involve 18-20 small to medium sized manufacturing companies. The companies will be advised by consultants on how to review their waste streams and produce actions plans to benefit the companies' performance and the environment, as well as reducing their compliance risk and improving their environmental credentials.