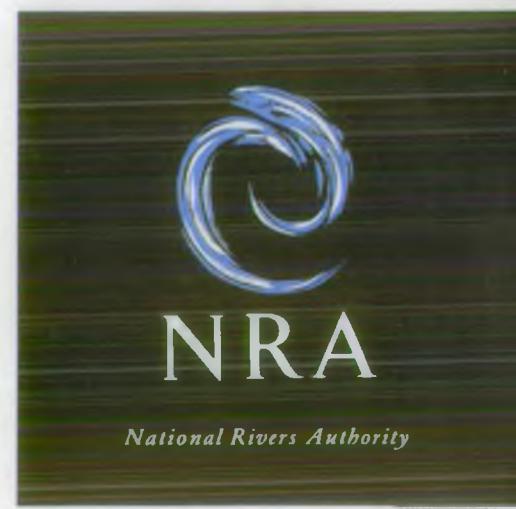


Project OS3  
R&D PRS  
2309-M

## Candidate Substances Requiring Environmental Quality Standards (EQSs)

WRc plc

R&D PRS 2309-M



CANDIDATE SUBSTANCES REQUIRING ENVIRONMENTAL QUALITY STANDARDS (EQSs)

Report No: PRS 2309-M

December 1989

Author: A R Agg

Contract Manager: T F Zabel

Contract No: 4752

Client's Reference No: 7.2.1a

RESTRICTION: This report is restricted to the National Rivers Authority  
and equivalent bodies in Scotland and Northern Ireland

National River  
Information  
Head Office

Class No .....

Accession No ALHX ....

Any enquiries relating to this report should be referred to the author  
at the following address:

WRc Medmenham, Henley Road, Medmenham, PO Box 16, Marlow,  
Buckinghamshire SL7 2BD. Telephone: Henley (0491) 571531

The views expressed in this document are not necessarily  
those of the NRA. Its officers, servants or agents accept no  
liability whatsoever for any loss or damage arising from the  
interpretation or use of the information, or reliance upon  
views contained herein.

## CANDIDATE SUBSTANCES REQUIRING ENVIRONMENTAL QUALITY STANDARDS (EQSs)

A R AGG\*

### SUMMARY

Environmental quality standards (EQSs) provide the basis for the management of surface water quality in the UK with national standards adopted for various potentially dangerous substances. In view of the requirement to set statutory quality objectives, it is appropriate to consider which additional substances are likely to be present in UK waters and need to be regulated for effective control of surface water quality.

Existing EQS development has been reviewed together with brief consideration of sources of potentially detrimental substances likely to affect surface water quality and for which standards may need to be derived for recognised uses of water.

Sources of possible pollutants for which EQSs may need to be derived for effective water quality management include domestic sewage effluents, including constituents of detergent formulations and household cleaning agents, water treatment chemicals, biocides and industrial effluents including flue-gas desulphurisation plant effluents. Most potentially important pollutants other than List I compounds can be ascribed to one of the categories of List II of the Dangerous Substances Directive for which member states are required to establish control programmes based on EQSs.

The sources identified should be reviewed in detail having regard to the experience of water quality managers concerning known problem areas and local industrial and agricultural practices.

\* Please contact Dr T F Zabel at WRc Medmenham if you have any queries.

Report No PRS 2309-M, November 1989

22 pages; 5 tables.

Project Ref: 7.2.1a.

## CONTENTS

	Page
SUMMARY	(i)
SECTION 1 - WHY EQSs ARE REQUIRED	1
SECTION 2 - SUBSTANCES ALREADY CONSIDERED	2
SECTION 3 - POTENTIAL CANDIDATE SUBSTANCES	4
3.1 LIST I SUBSTANCES	4
3.2 LIST II SUBSTANCES	10
3.3 RED LIST SUBSTANCES	11
3.4 DOMESTIC SEWAGE DETERMINANDS	12
3.5 WATER TREATMENT PLANT EFFLUENTS	14
3.6 BIOCIDES	15
3.7 SUBSTANCES PRESENT IN INDUSTRIAL EFFLUENTS	16
3.7.1 Flue-gas desulphurisation effluents	16
3.7.2 Selected chemicals	16
SECTION 4 - CONCLUSIONS	16
REFERENCES	22

## SECTION 1 - WHY EQSs ARE REQUIRED

Effective management of surface water quality requires information on the acceptable levels of contaminants for recognised uses of the water. This is the basis of UK policy and is inherent in the concept of integrated pollution control adopted for the control of particularly dangerous substances. It is now recognised that many substances reach surface waters by diffuse routes which are not amenable to control, except by restrictions on use such as the ban on the use of tributyltin in antifouling paints for small boats. Experience with implementing controls to reduce point source discharges of the more significant pollutants has highlighted the need to understand the behaviour of individual substances in the aquatic environment and to derive standards for surface water quality based on sound scientific criteria supported by good experimental and environmental data.

Such standards are essential for setting discharge limits for individual effluents and for allocating available capacity for assimilating polluting load between several discharges. It is worth noting that countries which prefer to use prescribed limit values for industrial effluents are increasingly aware of the need to consider the cumulative effects in the receiving water and to establish "safe" environmental concentrations. The move towards statutory quality objectives for surface waters reinforces the need for systematic consideration of substances affecting water quality.

Implementation of the EC Dangerous Substances Directive (CEC 1976) in the UK has produced EQSs for selected List I and II substances as summarised in Section 2. The list will be extended as standards are adopted by the EEC for other List I substances and by the Department of the Environment following consultation on EQSs proposed for additional List II substances. Provisional EQSs are also being prepared for those Red List substances for which EQSs have not yet been adopted.

While the control of dangerous substances is important, particularly to safeguard aquatic biota and maintain ecosystem integrity, there are

other factors of significance for water quality management. These include substances which can affect oxygen balance in the water, cause short-term deterioration of quality without necessarily causing significant pollution effects, and affect the aesthetic appearance of the water thus giving rise to public concern.

The purpose of Section 3 is to review substances in widespread use which are likely to reach surface waters in quantities sufficient to affect quality and for which EQSs may need to be developed. Substances considered include those likely to be present in sewage effluent (ie detergents and household cleansers), in water treatment plant effluents (ie aluminium and salts) and in discharges from particular industrial sectors such as flue-gas desulphurisation plants.

## **SECTION 2 - SUBSTANCES ALREADY CONSIDERED**

Standards have been agreed for a number of substances included in List I and List II of EC Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment (CEC 1976). The substances are listed in Table 1 and the standards are summarised in a DoE/Welsh Office Circular (DoE 1989).

Table 2 lists substances for which EQSs have been proposed or are actively being considered.

The EQS values for the four List I compounds listed have been proposed by the European Commission (CEC 1988). These are currently being considered by the EC Member States. Draft recommendations have been prepared for the List II and most of the Red List substances shown in Table 2 which are being discussed by the relevant bodies. In addition the EQS values for some of the substances adopted earlier (ie arsenic and chromium) are being reviewed in the light of new information published.

**Table 1. Substances for which EQS values have been agreed  
for various uses of fresh and saline water**

List I	List II
Mercury	Arsenic
Cadmium	Chromium
Hexachlorocyclohexane	Copper
Carbon tetrachloride	Lead
DDT	Nickel
Pentachlorophenol	Zinc
Drins	Boron
Hexachlorobenzene	* Iron
Hexachlorobutadiene	* pH
Chloroform	Vanadium
	Triorganotin compounds
	Mothproofing agents

\* Although iron and pH are not included in List II of the directive, the EQSs for these parameters are to be applied in the same way as those for List II substances.

**Table 2. Substances for which EQS values have been proposed or are actively being considered**

List I	List II	Red List
1,2-dichloroethane	Inorganic tin	Atrazine
Trichloroethylene	Sulphide	Simazine
Perchloroethylene	Ammonia	Endosulfan*
Trichlorobenzenes	Monochlorobenzene	Malathion
	Dichlorobenzenes	Penitrothion
	Trichlorobenzenes	Azinphos-methyl*
	Toluene	Trifluralin
	Xylenes	Dichlorvos
	Benzene	PCBs*
		1,2 dichloroethane*

\* Draft proposals in preparation

### **SECTION 3 - POTENTIAL CANDIDATE SUBSTANCES**

The terms of reference of this review are to identify, by taking a wide view of potential sources of chemicals reaching surface waters, those substances for which EQSs may need to be derived for water quality management. Some of the substances to be identified will already have been included in lists of 'dangerous' substances on the basis of their potential toxicity, persistence or bioaccumulation. Others should not be regarded as dangerous in the same terms but could cause local or short-term detrimental effects in surface waters if not adequately controlled.

The substances are considered by reference to their main sources, dealing first with any compounds which have been identified for regulation but for which standards have not been established. The lists may not be exhaustive; nor should they be interpreted as having a status other than a basis for discussion.

#### **3.1 LIST I SUBSTANCES**

EC Directive 76/464/EEC defines List I substances as belonging to the following families and groups of substances:

1. organohalogen compounds and substances which may form such compounds in the aquatic environment;
2. organophosphorus compounds;
3. organotin compounds;
4. substances in respect of which it has been proved that they possess carcinogenic properties in or via the aquatic environment<sup>(1)</sup>;
5. mercury and its compounds;
6. cadmium and its compounds;

7. persistent mineral oils and hydrocarbons of petroleum origin;

and for the purposes of implementing Articles 2, 8, 9 and 14 of this Directive:

8. persistent synthetic substances which may float, remain in suspension or sink and which may interfere with any use of the waters.

(1) Certain List II substances which are carcinogenic are included in Category 4.

The substances so far confirmed as List I are included in Categories 1, 5 and 6 (see Table 1). The EC published a priority list of 129 potential List I substances, as shown in Table 3, based on an assessment of the toxicity, persistence and bioaccumulation potential of over 1500 individual substances. Based on a UK initiative the EC is currently developing a selection procedure to set priorities for action for the 129 potential EC List I substances. Table 3 includes an indication of the status of the substances and of the progress made on setting limit values and EQSs for these substances. Studies commissioned by the EC to assess the environmental impact have been completed or are in progress on all the substances in Table 3 and further proposals are expected, probably initially for chloroanilines and chloro-nitro compounds.

**Table 3. List of substances which could belong to List I of Council Directive 76/464/EEC**

CAS number	Substance	Status
1. 309-00-2	Aldrin	List I
2. 95-85-2	2-Amino-4-chlorophenol	UK FPC Red List
3. 120-12-7	Anthracene	UK FPC Red List
4. 7440-38-2	Arsenic and its mineral compounds	confirmed as List II
5. 2642-71-9	Azinphos-ethyl	UK FPC Red List
6. 86-50-0	Azinphos-methyl	UK Red List
7. 71-43-2	Benzene	EQS values proposed (List II)
8. 92-87-5	Benzidine	
9. 100-44-7	Benzyl chloride (Alpha-chlorotoluene)	
10. 98-87-3	Benzylidene chloride (Alpha, alpha-dichlorotoluene)	
11. 92-52-4	Biphenyl	UK FPC Red List
12. 7440-43-9	Cadmium and its compounds	List I
13. 56-23-5	Carbon tetrachloride	List I
14. 302-17-0	Chloral hydrate	
15. 57-74-9	Chlordane	no action intended
16. 79-11-8	Chloroacetic acid	UK FPC Red List
17. 95-51-2	2-Chloroaniline	
18. 108-42-9	3-Chloroaniline	
19. 106-47-8	4-Chloroaniline	
20. 108-90-7	Chlorobenzene	EQS values proposed (List II)
21. 97-00-7	1-Chloro-2,4-dinitrobenzene	
22. 107-07-3	2-Chloroethanol	UK FPC Red List
23. 67-66-3	Chloroform	List I
24. 59-50-7	4-Chloro-3-methylphenol	
25. 90-13-1	1-Choronaphthalene	
26.	Choronaphthalenes (technical mixture)	
27. 89-63-4	4-Chloro-2-nitroaniline	
28. 89-21-4	1-Chloro-2-nitrobenzene	
29. 88-73-3	1-Chloro-3-nitrobenzene	
30. 121-73-3	1-Chloro-4-nitrobenzene	
31. 89-59-8	4-Chloro-2-nitrotoluene	UK FPC Red List
32.	Chloronitrotoluenes (other than 4-Chloro-2-nitrotoluene)	
33. 95-57-8	2-Chlorophenol	
34. 108-43-0	3-Chlorophenol	
35. 106-48-9	4-Chlorophenol	
36. 126-99-8	Chloroprene (2-Chlorobuta-1,3-diene)	
37. 107-05-1	3-Chloropropene (Allyl chloride)	
38. 95-49-8	2-Chlorotoluene	
39. 108-41-8	3-Chlorotoluene	
40. 106-43-4	4-Chlorotoluene	

Table 3 continued

CAS number	Substance	Status
41.	2-Chloro-p-toluidine	
42.	Chlorotoluidines (other than 2-Chloro-p-toluidine)	
43. 56-72-4	Coumaphos	
44. 108-77-0	Cyanuric chloride (2,4,6-Trichloro-1,3,5-triazine)	UK FPC Red List
45. 94-75-7	2,4-D (including 2,4-D-salts and 2,4-D-esters)	UK FPC Red List
46. 50-29-3	DDT (including metabolites DDD and DDE)	List I
47. 298-03-3	Demeton (including Demeton-o, Demeton-s, Demeton-s-methyl and Demeton-s-methyl-sulphone)	UK FPC Red List
48. 106-93-4	1,2-Dibromomethane	
49.	Dibutyltin dichloride	
50.	Dibutyltin oxide	
51.	Dibutyltin salts (other than Dibutyltin dichloride and Dibutyltin oxide)	
52.	Dichloroanilines	
53. 95-50-1	1,2-Dichlorobenzene	EOS values proposed UK FPC } (List II) Red List
54. 541-73-1	1,3-Dichlorobenzene	
55. 106-46-7	1,4-Dichlorobenzene	
56.	Dichlorobenzidines	
57. 108-60-1	Dichlorodiisopropyl ether	
58. 75-34-3	1,1-Dichloroethane	
59. 107-06-2	1,2-Dichloroethane	proposals published for List I, UK Red List
60. 75-35-4	1,1-Dichloroethylene (Vinylidene chloride)	UK FPC Red List
61. 540-59-0	1,2-Dichloroethylene	
62. 75-09-2	Dichloromethane	
63.	Dichloronitrobenzenes	
64. 120-83-2	2,4-Dichlorophenol	
65. 78-87-5	1,2-Dichloropropane	
66. 96-23-1	1,3-Dichloropropan-2-ol	UK FPC Red List
67. 542-75-6	1,3-Dichloropropene	UK FPC Red List
68. 78-88-6	2,3-Dichloropropene	
69. 120-36-5	Dichlorprop	
70. 62-73-7	Dichlorvos	UK Red List
71. 60-57-1	Dieldrin	List I
72. 109-89-7	Diethylamine	
73. 60-51-5	Dimethoate	
74. 124-40-3	Dimethylamine	UK FPC Red List
75. 298-04-4	Disulfoton	
76. 115-29-7	Endosulfan	UK Red List

Table 3 continued

	CAS number	Substance	Status
77.	72-20-8	Endrin	List I
78.	106-89-8	Epichlorohydrin	
79.	100-41-4	Ethylbenzene	UK FPC Red List
80.	122-14-5	Fenitrothion	UK Red List
81.	55-38-9	Fenthion	UK FPC Red List
82	76-44-8	Heptachlor (including Heptachlorepoxyde)	no action intended
83.	118-74-1	Hexachlorobenzene	List I
84.	87-68-3	Hexachlorobutadiene	List I
85.	608-73-1	Hexachlorocyclohexane	List I
	58-89-9	(including all isomers and Lindane)	
86.	67-72-1	Hexachloroethane	UK FPC Red List
87.	98-83-9	Isopropylbenzene	
88.	330-55-2	Linuron	UK FPC Red List
89.	121-75-5	Malathion	UK Red List
90.	94-74-6	MCPA	
91.	93-65-2	Mecoprop	
92.	7439-97-6	Mercury and its compounds	List I
93.	10265-92-6	Methamidophos	
94.	7786-34-7	Mevinphos	UK FPC Red List
95.	1746-81-2	Monolinuron	
96.	91-20-3	Naphthalene	
97.	1113-02-6	Omethoate	
98.	301-12-2	Oxydemeton-methyl	
99.		PAH (with special reference to: 3,4-Benzopyrene and 3,4-Benzofluoranthene)	
100.	56-38-2 298-00-0	Parathion (including Parathion-methyl)	UK FPC Red List
101.	87-86-5	PCB (including PCT)	UK Red List
102.	14816-18-3	Pentachlorophenol	List I
103.	709-98-8	Phoxim	
104.	1698-60-8	Propanil	
105.	122-34-9	Pyrazon	UK FPC Red List
106.	93-76-5	Simazine	UK Red List
107.		2,4,5-T (including 2,4,5-T salts and 2,4,5-T esters)	
108.		Tetrabutyltin	
109.	95-94-3	1,2,4,5-Tetrachlorobenzene	
110.	79-34-5	1,1,2,2-Tetrachloroethane	
111.	127-18-4	Tetrachloroethylene	proposals published for List I
112.	108-88-3	Toluene	EQS values proposed (List II)
113.	24017-47-8	Triazophos	
114.	126-73-8	Tributyl phosphate	
115.		Tributyltin oxide	List II, UK Red List

Table 3 continued

CAS number	Substance	Status
116. 52-68-6	Trichlorfon	
117.	Trichlorobenzene (technical mixture)	}
118. 120-82-1	1,2,4-Trichlorobenzene	
119. 71-55-6	1,1,1-Trichloroethane	UK FPC Red List
120. 79-00-5	1,1,2-Trichloroethane	
121. 79-01-6	Trichloroethylene	proposals published for List I
122. 95-95-4 88-06-2	Trichlorophenols	
123. 76-13-1	1,1,2-Trichlorotrifluoroethane	
124. 1582-09-8	Trifluralin	UK Red List
125. 900-95-8	Triphenyltin acetate (Fentin acetate)	
126.	Triphenyltin chloride (Fentin chloride)	}
127. 76-87-9	Triphenyltin hydroxide (Fentin hydroxide)	
128. 75-01-4	Vinyl chloride (Chloroethylene)	
129.	Xylenes (technical mixture of isomers)	EQS values proposed (List II)

FPC - 'first priority candidate' Red List compounds (see Section 3.3)

### **3.2 LIST II SUBSTANCES**

EC Directive 76/464/EEC defines List II substances as follows:

- substances belonging to the families and groups of substances in List I for which the limit values referred to in Article 6 of the Directive have not been determined;
- certain individual substances and categories of substances belonging to the families and groups of substances listed below and which have a deleterious effect on the aquatic environment, which can, however, be confined to a given area and which depend on the characteristics and location of the water into which they are discharged.

**Families and groups of substances referred to in the second indent**

1. The following metalloids and metals and their compounds:

1. zinc	6. selenium	11. tin	16. vanadium
2. copper	7. arsenic	12. barium	17. cobalt
3. nickel	8. antimony	13. beryllium	18. thalium
4. chromium	9. molybdenum	14. boron	19. tellurium
5. lead	10. titanium	15. uranium	20. silver

2. Biocides and their derivatives not appearing in List I.
3. Substances which have a deleterious effect on the taste and/or smell of the products for human consumption derived from the aquatic environment, and compounds liable to give rise to such substances in water.
4. Toxic or persistent organic compounds of silicon, and substances which may give rise to such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances.

5. Inorganic compounds of phosphorus and elemental phosphorus.
6. Non persistent mineral oils and hydrocarbons of petroleum origin.
7. Cyanides, fluorides.
8. Substances which have an adverse effect on the oxygen balance, particularly: ammonia, nitrates.

Progress in establishing UK national EQS values for List II substances is indicated in Tables 1 and 2. Priority has been given to substances known to be present in UK waters and likely to be detrimental to the beneficial uses of surface waters.

List II includes potential (but unconfirmed) List I substances, specific elements and their compounds, and various classes of substances (eg biocides, those affecting taste and/or smell, and those having an adverse effect on the oxygen balance). Thus virtually all the substances to be identified as requiring EQSs for water could be accommodated within the above definition of List II.

### 3.3 RED LIST SUBSTANCES

The UK is giving priority to the control of Red List substances, including the preparation of provisional EQSs for the main uses of water. The 23 Red List substances given in Table 4 include all List I substances except chloroform and carbon tetrachloride, and the two proposed List I compounds (1,2-dichloroethane and trichlorobenzene).

UK Red List status is also identified in Table 3, together with that of the 'first priority candidate' (FPC) substances to be considered for inclusion on the Red List when more information is available and an assessment of their toxicity, persistence and potential for bioaccumulation has been carried out.

**Table 4 - The UK 'Red List' substances**

	EC Directive adopted (List I status)
Mercury	+
Cadmium	+
gamma - hexachlorocyclohexane (lindane)	+
DDT	+
Pentachlorophenol (PCP)	+
Hexachlorobenzene (HCB)	+
Hexachlorobutadiene (HCBD)	+
Aldrin	+
Dieldrin	+
Endrin	+
PCB (Polychlorinated biphenyls)	
Tributyltin compounds*	
Triphenyltin compounds*	
Dichlorvos	
Trifluralin	
1,2 Dichloroethane	
Trichlorobenzene	
Azinphos-methyl	
Fenitrothion	
Malathion	
Endosulfan	
Atrazine	
Simazine	

\* UK List II substance

### **3.4 DOMESTIC SEWAGE DETERMINANDS**

The present classification of surface water quality is based primarily on levels of dissolved oxygen (DO), biochemical oxygen demand (BOD) and ammonia. These so-called 'sanitary' determinands are closely related to the presence of domestic sewage effluent, the levels being set arbitrarily as class-limiting criteria on the basis of experience rather than derived according to the established EQS assessment procedure.

Ammonia has been reviewed as part of the national EQS programme (see Table 2) although no formal standards have been adopted so far by DoE

except for designated salmonid and cyprinid fisheries for which the standards set in the Freshwater Fish Directive (CEC 1978) are applicable. A review of DO is in progress as part of the WRc research programme for the NRA. Although BOD provides a basis for controlling discharges of sewage effluent, it is questionable whether EQSs for this parameter are relevant in addition to DO for assessing surface water quality. It should also be noted that alternatives to BOD are being investigated because of the difficulties inherent in the BOD test for operational management. There is a general increase in awareness of the problems caused by eutrophication (algal blooms in reservoirs and coastal waters). Nutrients (nitrogen and phosphorus) present in sewage effluent and originating from diffuse sources are the major cause of eutrophication. Work is in hand to assess the concentrations of nutrients likely to lead to eutrophication problems.

The number of different detergent and household cleaner formulations has increased significantly in recent years largely because of the marketing of "green" products. Although the detergents approved for general use are biodegradable, residues and degradation products are usually present in sewage effluents. The formulations also often contain phosphorus which can contribute to eutrophication and which is therefore being replaced in the new formulations by other substances such as Zeolites or polymers (ie polycarboxylates). Many of the detergent formulations, the biologically active washing powders, contain enzymes which are likely to be present in sewage effluents. The various constituents of detergents and household cleaners need to be considered in the context of receiving water quality.

The bacterial content of sewage effluent is important because of the need to regulate water quality in selected areas for bathing and water-contact recreational uses. Indicator bacteria survive conventional sewage treatment in large numbers (despite up to 99% removal in secondary biological treatment). Pathogens and viruses, if present, are likely to be more resistant than indicator organisms such as coliforms or faecal streptococci. The EC Directive on bathing water quality (76/160/EEC) includes standards for bacteria although these were

not based on epidemiological evidence. The USEPA guideline standards for bathing waters are now based on enterococci rather than the bacteria specified in the EC Directive.

Disinfection of sewage effluents is not widely practised but could be adopted for discharges to sensitive recreational waters if concern about the potential risks of water-transmitted diseases continues to increase. Chlorine is the cheapest disinfectant, although the effectiveness of other agents (chlorine dioxide, peracetic acid and ozone) is being investigated. The chemical by-products of disinfection, particularly chlorinated organic compounds, should be considered for EQS evaluation unless already covered (see Table 3).

Although not specifically attributable to sewage effluent discharges, a number of waterborne organisms give rise to concern about health-related aspects of water contact sports. These include leptospira, cryptosporidium and the toxins released by some blue-green algae such as *Microcystis*.

### 3.5 WATER TREATMENT PLANT EFFLUENTS

The use of chemicals in water treatment is widespread for both potable supplies and process water used by industry. The use of aluminium in potable water treatment is declining following evidence of a link with Alzheimer's disease and adverse publicity about the Camelford incident. Aluminium levels in some surface waters have increased as a result of acidification of clay soils. There are no UK standards for aluminium in surface waters although Canadian studies (Ontario and British Columbia) have produced pH-dependent criteria for fisheries. Iron salts are used in preference to aluminium in some areas and EQSs for iron have been established (see Table 1). Polyelectrolytes are also widely used for coagulation and have not been assessed for their likely effect on receiving water quality.

Denitrification processes based on ion-exchange will give rise to effluents containing high concentrations of chloride, nitrate and

sodium. Degradation of the resins may also lead to contamination of water and effluents.

The large quantities of cooling and process waters used by industry need careful consideration. Much is recycled following in-plant treatment, but the impact of large volumes containing low concentrations of contaminants may be significant particularly at times of low flow in the receiving water. Potential problems include elevated temperature, biocides (see Section 3.6), and salinity.

### 3.6 BIOCIDES

By the nature of their use as environmental control agents, biocides will reach surface waters predominantly by diffuse routes. Some will also arise from manufacturing and formulation plants, treatment of cooling and process waters, their use (ie for mothproofing and sheep dips) and as a result of accidental or careless spillage. They include pesticides, herbicides, fungicides and algicides, ranging from specialist single-target chemicals to broad-spectrum agents intended for general use.

Many of the more toxic and persistent biocides are organo-halogen or organo-phosphorus compounds which are included in the lists of dangerous substances already regulated or under review (see Section 2). Any new chemicals introduced are subject to the regulations implementing EC Directive 79/831/EEC relating to the classification, packaging and labelling of dangerous substances. Efforts must be made to ensure that the information supplied is adequate for establishing EQSs and that analytical methods are available to enable the appropriate concentrations to be measured in surface water samples.

A review of biocides currently marketed for use in the UK should be made to ensure that those likely to reach surface waters in significant concentrations are adequately assessed. Some substances, for instance those on the UK 'first priority candidate' Red List (see Table 3), require additional data on their toxicity, persistence and potential for bioaccumulation before they can be fully evaluated.

## **3.7 SUBSTANCES PRESENT IN INDUSTRIAL EFFLUENTS**

### **3.7.1 Flue-gas desulphurisation effluents**

Scrubbing of power station gases to reduce sulphur emissions, and subsequent neutralisation of the liquors, will produce substantial quantities of effluent contaminated with many inorganic compounds. The actual composition will depend on the process used (limestone-gypsum or regeneration), the quality and impurities of the coal and the process chemicals in actual use. The scale of the flue-gas desulphurisation (FGD) operation and the continuous nature of the process may place significant demands on the capacity of receiving waters in the vicinity of power stations. It is likely that most of the metals, metalloids and cations identified in List II (see Section 3.2) will be present in FGD effluents. It will be necessary to consider appropriate EQSs for those components not already covered.

### **3.7.2 Selected chemicals**

A list has been prepared by the water industry of substances likely to be used or stored in sufficient quantities to pose a potential risk to receiving waters. Included in the list are most of the potential List I substances (Table 3) but also the additional compounds shown in Table 5. There is a need to assess whether EQSs are required for any of these substances.

## **SECTION 4 - CONCLUSIONS**

EC Directive 76/464/EEC provides the basis for controlling substances considered to cause pollution of surface waters by means of EQSs. It is expected that the EC will continue its programme to set limit values and EQSs for many of the potential List I substances in Table 3. In the UK national programme priority will be given to setting EQS values for the 'Red List' substances, for which EQSs have not yet been adopted, and for selected List II substances.

Table 5 - Selected chemicals not included as potential List I compounds

CAS number	
108-24-7	ACETIC ANHYDRIDE
67-64-1	ACETONE
75-05-8	ACETONITRILE
79-06-1	ACRYLAMIDE
	ALKYL BENZENE SULPHONIC ACID (ALKYL?)
	AMITRAZ
62-53-3	ANILINE
100-66-3	ANISOLE
	ASULAM
100-52-7	BENZALDEHYDE
120-80-9	1,2-BENZENEDIOL (CATECHOL)
94-09-7	BENZOCAINE
65-85-0	BENZOIC ACID
99-76-3	BENZOIC ACID, 4-HYDROXY METHYL ESTER
95-16-9	BENZOTHIAZOLE
117-81-7	BIS-(2-ETHYLHEXYL) PHTHALATE
	BROMOXYNIL
78-92-2	2-BUTANOL
71-36-3	1-BUTANOL
63-25-2	CARBARYL
10605-21-7	CARBENDAZIM
75-15-0	CARBON DISULPHIDE
36653-82-4	CETYL ALCOHOL
	CHLORFENVINPHOS
	CHLORMEQUAT
79-11-8	CHLOROETHANOIC ACID
	4-CHLORO-2-NITRO PHENOL
	CHLORTHIAMID
	CHLORTOLURON
	COCONUT DIETHANOL AMIDE
	CREOSOTE
	CRESOLS
	CYANIDES
420-04-2	CYANOGENAMIDE
108-93-0	CYCLOHEXANOL
108-94-1	CYCLOHEXANONE
	CYHALOTHrin
	CYPERMETHrin
75-99-0	DALAPON
123-42-2	DIACETONE ALCOHOL
333-41-5	DIAZINON
	DIBROMOETHANE
	DICAMBA
	DICHLOBENIL
133-53-9	2,4-DICHLORO-3,5-XYLENOL
60-29-7	DIETHYL ETHER
103-23-1	DI-(ETHYLHEXYL) ADIPATE

Table 5 continued

CAS number

84-66-2	DIETHYLPHthalATE
	DIFLUBENZURON
513-85-9	2,3-DIHYDROXYBUTANE
95-68-1	2,4-DIMETHYL ANILINE
589-93-5	2,5-DIMETHYL PYRIDINE
88-85-7	DINOSEB
	1,3-DIPHENYLGUANIDE
	DIQUAT
120-78-5	2,2-DITHIOBISBENZOTHIAZOLE
	4,4-DITHIOMORPHOLINE
330-54-1	DIURON
534-52-1	DNOC
141-78-6	ETHYL ACETATE
107-21-1	ETHYLENE GLYCOL
111-76-2	ETHYLENE GLYCOL MONOBUTYL ETHER
110-80-5	ETHYLENE GLYCOL MONOETHYL ETHER
	FLUMETHRIN
50-00-0	FORMALDEHYDE
64-18-6	FORMIC ACID
	FOSAMINE AMMONIUM
67-45-8	FURAZOLIDONE
98-00-0	FURFURYL ALCOHOL
56-81-5	GLYCERINE
56-40-6	GLYCINE
	GLYPHOSATE
	HEXAHYDRO PYrimidine (HHP)
110-54-3	n-HEXANE
142-62-1	HEXANOIC ACID
7722-84-1	HYDROGEN PEROXIDE
	IMAZAPYR
99-89-8	IOXYNIL (ESTERS AND/OR FREE?)
	p-ISOPROPYLPHENOL
	ISOPROTURON
103-72-0	ISOTHIOCYANATOBENZENE
569-64-2	MALACHITE GREEN
123-33-1	MALEIC HYDRAZIDE
	MANCOZEB
	MANEB
	MCPB
108-78-1	MELAMINE
149-30-4	2-MERCAPTOBENZOTHIAZOLE
67-56-1	METHANOL
	METHYL CYCLOHEXANOL
96-33-3	METHYL, ETHYL & BUTYL ACRYLATES
78-93-3	METHYL ETHYL KETONE
108-10-1	METHYL ISOBUTYL KETONE
109-06-8	2-METHYL PYRIDINE

Table 5 continued

CAS number	
119-36-8	METHYL SALICYLATE 2-(METHYL SULFINYL)BENZOTHIAZOLE
	METHYL SULPONE BENZOTHIAZOLE
120-75-2	METHYLBENZOTHIAZOLE 2-METHYLBENZOTHIAZOLETHIOL
110-91-8	MORPHOLINE MORPHOLINE, 4-THIOCARBONIC ACID ANILIDE- 2-MORPHOLINOBENZOTHIAZOLE MORPHOLINYL, METHYL CARBODITHIOATE- NAPHTHALENE SULPHONATE
98-95-3	NITROBENZENE
55-63-0	NITROGLYCERINE NONYL PHENYL ETHOXYLATE
144-62-7	OXALIC ACID OXOLINIC ACID
123-63-7	PARALDEHYDE PARAQUAT
71-41-0	1-PENTANOL
7722-86-3	PERSULPHURIC ACID
108-95-2	PHENOL
140-29-4	PHENYL ACETONITRILE (BENZYL CYANIDE)
122-78-1	PHENYLACETALDEHYDE PHTHALIMIDE, N-(CYCLOHEXYL THIO)- PIRIMICARB PIRIMIPHOS-METHYL
	PROPAN-2-OL PROPAN-1-OL PROPАЗINE PROPETAMPHOS
57-55-6	PROPYLENE GLYCOL PROPYZAMIDE
110-86-1	PYRIDINE
7631-90-5	SODIUM BISULPHITE
7681-52-9	SODIUM HYPOCHLORITE
140-93-2	SODIUM ISO-PROPYL XANTHATE SODIUM LAURYL ETHYL SULPHONATE
132-27-4	SODIUM O-PHENYLPHENATE
7757-83-7	SODIUM SULPHITE SODIUM XYLENE SULPHATE (ISOMER?)
	TERBUTRYNE
79-57-2	TERRAMYCIN
62-56-6	THIOUREA TRIBRISSEN
	3,4,4-TRICHLOROCARBONILIDE 2,3,4-TRICHLOROCARBONILIDE
75-69-4	TRICHLOROFLUOROMETHANE

**Table 5 continued**

---

CAS number

---

147-47-7	TRIDEMORPH
115-96-8	TRIMETHYL-1,2-DIHYDROQUINOLINE
6145-73-9	TRIS(2-CHLOROETHYL) PHOSPHATE
57-13-6	TRIS(2-CHLOROPROPYL) PHOSPHATE
	UREA
	XYLENE SULPHONIC ACID (ISOMER?)

List II of Directive 76/464/EEC encompasses most of the other substances considered detrimental to water quality and for which EQSs should be derived (Section 3.2). EQSs have been established for 12 substances or groups of substances (Table 1) within the UK national programme and proposals for another nine are under consideration (Table 2).

EQSs should be agreed for ammonia (already reviewed), and for DO and for the nutrients to control eutrophication (in progress).

There is a need to consider substances present in sewage effluents (detergent and household cleaning constituents) and in effluents from water treatment plants (aluminium, polyelectrolytes, chloride and sodium). Bacteria associated with sewage effluents, together with other waterborne pathogens such as leptospira and cryptosporidium, are important for some uses of surface waters. If disinfection of sewage effluents is practised, the effect of disinfectant residuals and by-products requires assessment.

Although many of the biocides in current use in the UK are included in List I, the use of biocides should be reviewed and EQSs should be derived where appropriate.

Industrial sources of potentially polluting substances should be reviewed to ensure that chemicals known to be in use and likely to reach surface waters are accounted for, with EQSs to be derived in appropriate cases. In particular, effluents from flue-gas desulphurisation plants should be considered.

## REFERENCES

COMMISSION OF EUROPEAN COMMUNITIES (1988) Proposal for a Council Directive amending and supplementing Annex II to Directive 86/280/EEC on limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive 76/464/EEC. Official Journal C253, 29 September 1988.

COUNCIL OF EUROPEAN COMMUNITIES (1976) Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community. 76/464/EEC. Official Journal L129, 18 May 1976.

COUNCIL OF EUROPEAN COMMUNITIES (1978) Council Directive on the quality of fresh waters needing protection or improvement in order to support fish life. 78/659/EEC. Official Journal L222, 14 August 1978.

DEPARTMENT OF THE ENVIRONMENT/WELSH OFFICE (1989) Water and the environment. The implementation of European Community directives on pollution caused by certain dangerous substances discharged into the aquatic environment. Circular 7/89(DoE), 16/89 (Welsh Office). 30 March 1989.