SOUTH WESTERN RIVER BASIN DISTRICT

Final Report

Dangerous Substances Usage Programme of Measures Study

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in association with

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Revision Control Table

The User is Responsible for Checking the Revision Status of this Document

Rev	Description of Changes	Prepared by	Checked by	Approved by	Date
A	Draft Issued to Dangerous Substances Steering Group	KR/FM	GG	GG	21st December 2007
B	With Comments From Dangerous Substances Expert Group	KR/FM	GG	GG	18th March 2008
C	With Further Comments From Dangerous Substances Expert Group	KR/FM	GG	GG	5th June2008

Abbreviations

AER	-	Annual Environmental Reports
BTEX	-	Benzene, toluene, ethylbenzene and xylene
CAS	-	Chemical Abstract Service
CIRCA	-	Communication and Information Resource Centre Administrator
CTC	-	Clean Technology Centre
DAFF	-	Department of Agriculture, Fisheries and Food
DCMNR	-	Department of the Communications, Marine and Natural Resources
DED	-	District Electoral Division
DEFRA	-	Department of Environmental, Food and Rural Affairs
ECHA		European Chemicals Agency
EPA	-	Environmental Protection Agency
EPER	-	European Pollutant Emission Register
E-PRTR	-	European Pollutant Release and Transfer Register
EQS	-	Environmental Quality Standard
EU	-	European Union
FIPS	-	Forest Inventory and Planning System
FSC	-	Forest Stewardship Consul
GIS	-	Geographical Information Systems
GSI	-	Geological Survey of Ireland
HSA	-	Health and Safety Authority
IACS	-	Integrated Administration and Control Systems
IPPC	-	Integrated Pollution Prevention Control
IT	-	Information Technology
LOD	-	Limit of Detection
MAC	-	Maximum Allowable Concentrations
MSDS	-	Material Safety Data Sheets
NACE	-	European industrial activity classification
NI	-	Northern Ireland
OEE	-	Office of Environmental Enforcement
PAH	-	Polycyclic Aromatic Hydrocarbon
PCS	-	Pesticide Control Service
PE	-	Population Equivalent
POMS	-	Programme of Measures and Standards
RBD	-	River Basin District
RBMP	-	River Basin Management Plan

REACH	-	Registration, Evaluation, Authorisation and Restriction of Chemicals
RIA	-	Regulatory Impact Assessment
SEPA	-	Scottish Environmental Protection Agency
SI	-	Statutory Instrument
SWRBD	-	South Western River Basin District
UK	-	United Kingdom
UKWIR	-	United Kingdom Water Industry Research
WFD	-	Water Framework Directive
WRBD	-	Western River Basin District
WWTP	-	Waste Water Treatment Plants
VOC	-	Volatile Organic Carbon

Glossary

Afforestation: The growing of trees in an area that has lacked forest cover for a very long time or has never been forested.

Chemical Status: Chemical Status describes whether waters contain safe levels of certain chemicals that have been identified as of significant risk to or via the aquatic environment at an EU level.

Classification System: A technical procedure for assessing the status of a water body in accordance with the requirements of the Water Framework Directive (WFD).

Dangerous Substances Directive: (76/464/EEC) Council Directive of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community.

Environmental Quality Standard (EQS): Specifies the absolute compliance concentration or range for a water quality element in the environment, failure of which will be reported to the European Commission.

Good Status: The status achieved by a surface waterbody when both its *ecological status* and its *chemical status* are at least 'Good'.

NACE Code: Classification of economic activities in the European Community.

Operational Monitoring: One of three types of monitoring specified in the WFD in order to:

- establish the status of those water bodies identified as being at risk of failing to meet their environmental objectives, and
- assess any changes in the status of such water bodies resulting from the programmes of measures.

In order to assess the magnitude of the pressure to which bodies of surface water are subject, operational monitoring is to be carried out for the following quality elements which are indicative of the pressures to which the body or bodies are subjected:

- parameters which are indicative of the biological quality element, or elements, most sensitive to the pressures to which the water bodies are subject,
- all priority substances discharged, and other pollutants discharged in significant quantities,
- parameters which are indicative of the hydromorphological quality element most sensitive to the pressure identified.

Priority Action Substances: is a term applied by the National Dangerous Substances Expert Group to the following substances: Annex X (WFD) and Annex IX (WFD- relating to the Dangerous Substances 76/464/EEC Daughter Directives).

Priority Hazardous Substances: According to the Water Framework Directive 2000/60/EC 1 (WFD), priority hazardous substances are defined as those among the priority substances that are toxic, persistent and liable to bio-accumulate, and other substances which give rise to equivalent level of concern (Definition, Article 2.29 and 2.30, WFD).

Priority Substances: are substances identified in accordance with WFD Article 16(2) and listed in Annex X (33 Substances). Among these substances there are 'priority hazardous substances' which means substances identified in accordance with WFD Article 16(3) and (6) for which measures have to be taken in accordance with Article 16(1) and (8).

Programmes of Measures (POMs): Protection measures that must be implemented to meet the environmental objectives of the WFD.

River Basin District (RBD): The area of land and sea, made up of one or more neighbouring river basins, together with their associated groundwaters and coastal waters, as the main unit for management of river basins.

Specific Relevant Pollutants: These are certain synthetic substances (e.g. biocides and plant protection products) and certain non-synthetic substances (e.g. metals) listed in 1 – 9 of Annex VIII of the WFD that are discharged in significant quantities to surface waters in Ireland and are not identified on the EU priority list.

Surveillance Monitoring: One of three types of monitoring specified in the WFD. Its objectives are to provide information for:

- supplementing and validating the impact assessment procedure detailed in Annex II of WFD,
- the efficient and effective design of future monitoring programmes,
- the assessment of long-term changes in natural conditions, and
- the assessment of long-term changes resulting from widespread anthropogenic activity.

Surveillance monitoring is to be carried out for each surveillance monitoring site for a period of one year during the period covered by a river basin management plan for:

- parameters indicative of all *biological quality elements*,
- parameters indicative of all *hydromorphological quality elements*,

- parameters indicative of all *general component (physico-chemical) quality elements*,
- priority pollutants which are discharged into the river basin or sub-basin, and
- other pollutants discharged in significant quantities in the river basin or sub-basin.

Water Framework Directive (WFD): Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

Water Policy Regulations: Irish Statutory Instruments which support the WFD, EC Water policy Regulations (S.I No. 722 of 2003) and EC Water Policy Regulations (Amendment) (S.I. No. 413 of 2005).

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1.0 Introduction

"The term dangerous substances describes a wide range of chemicals that may be toxic to people, plants and animals and are harmful to our water environment. They are contained in many everyday products used increasingly in households (for example medicines and cleaning products), industry, forestry, agriculture, small businesses, mines, construction sites and water treatment works. Surface run-off from roads and urban areas can also contain dangerous substances from motor vehicle emission". (South Eastern River Basin District, 2007)

The Water Framework Directive (WFD) 2000/60/EC, introduced in 2000, is the most significant piece of water-related legislation in Europe to date. The WFD was transposed into Irish law by the European Communities (Water Policy) Regulations 2003 (S.I. No 722 of 2003) and European Communities (Water Policy) Regulations (Amendment) (S.I. No. 413 of 2005). Previous water related legislation has been fragmented but the WFD takes a more co-ordinated and holistic approach. The WFD's main objective is to achieve at least good status in all waters by 2015.

Good status under the WFD will include good chemical and good ecological status. Both ecological and chemical status will be determined by reference to chemical environmental quality standards.

Under Article 16 of the WFD, on the 17th July 2006, the Commission adopted a proposed Directive setting environmental quality standards for the priority substances which Member States must achieve by 2015, to ensure "good chemical surface water status".

The definition of "Dangerous Substances" incorporates all of the following groups and was adopted from the discussion document produced in 2004 by Ireland's National Dangerous Substances Expert Group (National Dangerous Substances Expert Group, 2004):

- Priority Action Substances is a term applied by Ireland's National Dangerous Substances Expert Group to the Annex X (WFD) and Annex IX (WFD- relating to the Dangerous Substances 76/464/EEC Daughter Directives) substances. Among the substances in Annex X there are 'priority hazardous substances' which means substances identified in accordance with WFD Article 16(3) and (6) for which measures have to be taken in accordance with Article 16(1) and (8))
- Specific Relevant Pollutants are specific synthetic and non synthetic substances (not on the priority action substance list) whose presence in Irish waters may lead to a risk of failing the objectives of the WFD. (Phase 1 of the EQS development proposed standards for 18 of the

specific relevant pollutants in Ireland from an original candidate list of 161 substances (Environmental Protection Agency, 2007 a)).

1.1 Scope

Ireland's Characterisation report submitted to the European Commission under Article 5 of the WFD highlighted knowledge gaps. These gaps in information need to be filled to establish the status of water bodies and to develop River Basin Management Plans (RBMP) containing a programme of measures for reporting to the European Commission in 2010. The Programme of Measures and Standards (POMS) studies were established to fill the knowledge gaps identified in the Characterisation report. The Dangerous Substances Usage POMS study is one of thirteen national POMS studies. The Characterisation report highlighted that detailed quantification of dangerous substances presence and loads were not available. Further study on the usage of dangerous substances in Ireland was required to fill the data gaps.

Under the WFD a dangerous substances screening programme has been carried out. The screening programme involved investigative monitoring of water, sediment and biota for dangerous substances. The purpose of the screening programme was to assess if substances on the EU priority lists and candidate lists developed by Ireland's Dangerous Substances Expert Group were detected in significant concentrations, by obtaining concentration data for these substances and comparing these against suitable benchmarks. The Dangerous Substances Usage POMS study complemented the dangerous substances screening study. The Dangerous Substances Usage POMS study included gathering information on the specific sources of the substances listed in Annex X and IX as well as those found in the screening study.

1.2 Objectives of Dangerous Substances Programme of Measures and Standards (POMS) study

The key objectives of the Dangerous Substances Usage POMS study are summarised as follows:

- To establish (via literature review and examination of Irish datasets) the dangerous substances likely to arise in Irish water bodies due to particular human activities.
- To provide information and/or tools for the ongoing collation of the pressures and sources of dangerous substances in Irish water bodies.
- To establish a framework for the licensing and control of dangerous substances discharges.
- To optimise the design of the facility (i.e. point source) and status monitoring programmes to be established in accordance with Article 8 of the WFD.

The focus of the Dangerous Substances usage study was on the manufacturing and processing industry's use of dangerous substances. Investigations were also carried out on the use of dangerous substances in forestry, agriculture and aquaculture.

2.0 Methodology

2.1 Literature Review

A literature review was prepared to establish possible sources of dangerous substances. The literature was collated by the consultants with advice from the Dangerous Substances Expert Group and included literature from national studies, UK/SEPA studies and European guidance. The literature review noted dangerous substances related legislation, guidance and associated documents. The studies were related to anthropogenic usage of dangerous substances and the main part of the review was structured according to different sources of use, the first being industry, then agriculture, domestic and service sector use, municipal sources, fisheries and marine, transport networks, diffuse sources and mines and contaminated lands.

The legislation and associated guidance documents that were examined included documents produced as part of the development of the Priority Substances Directive. Information on the common uses of the priority substances and the priority hazardous substances is presented in these documents. Best environmental practice measures contained in a report carried out by the Clean Technology Centre (Clean Technology Centre, 1999) were also examined when developing the measures for this study.

The Commission's substance source sheets also provided information on the likelihood of priority substances discharges from IPPC and non-IPPC industries (Directorate General for Environment, 2004); these along with the information from a questionnaire of IPPC licence holders were examined when developing measures for the dangerous substances usage study.

A large amount of the literature and tools available from UK based sources were examined to see if the information was relevant to the Irish situation. It was noted that the industrial sectors in Ireland and the UK are similar. Spreadsheets were produced from UK Department of Environment reports on likely dangerous substances from different industry types (Department of Environment, 1996). These spreadsheets were used as likely sources of substances when applying industrial risk assessments for dangerous substances.

Domestic sources and service sector usage data is difficult to quantify. The information from a UK Water Industry Research (UKWIR) catchment study gives information on the substances that are associated with domestic use (Ross *et al* 2004). There is also some information available on the source screening and measures sheets for the priority substances associated with domestic use (Directorate General for Environment, 2004). Quantifying the domestic and service sector use of dangerous substances is problematic at this stage.

The literature review identified international systems and procedures that were of use when developing measures for the River Basin Management Plans. The literature review highlighted that the data that is currently available on the use of dangerous substances in Ireland is not comprehensive and is being improved by additional surveys (for example the Department of Agriculture, Fisheries and Food pesticide usage surveys) and registration programmes (for example the REACH regulation (Registration, Evaluation, Authorisation and Restriction of Chemicals)).

2.2 Monitoring Data Review

2.2.1 Screening monitoring programme

Ireland's national dangerous substances screening monitoring programme ran from May 2005-October 2006. Its purpose was to identify dangerous substances relevant to water quality in an Irish context by testing for the relevance of candidate substances in waters and therefore to guide the design of the WFD dangerous substances monitoring programme.

Initially 23 sites were monitored from May 2005-May 2006. These sites included 17 surface water sites, 4 groundwater sites and two facility sites (a landfill and a waste water treatment plant). Monthly water samples were taken at each site over 12 months (analysis was not carried out in December 2005). One sediment and one biota sample was also taken at each of the 17 surface water sites.

Overall 148 candidate relevant pollutants were analysed as part of the screening programme by TNO laboratory located in Appledorn, Holland (TNO, 2007 a & c).

Six additional target sites were added to the programme, these were monitored from April until October 2006.

Three of these target sites were located in the North South Share study area. These were included, so that information could be gathered on cross border sites. There were no significant additional substances detected at these sites that had not shown up previously within the monitoring programme.

Two additional target sites were included in the South Western River Basin District. These were chosen as they were a high status site and for use as part of the water quality modelling project. Again no additional substances were found in the target sites that had not been found in any of the other sites monitored (TNO, 2007 b).

A group of sites was also selected to focus monitoring on substances used in forestry and sheep dipping activities. The limited monitoring detected one pesticide at slightly elevated concentrations.

The results of this national screening monitoring programme were reviewed to develop a shortened list of 28 substances of the specific relevant pollutant substances which will be monitored in addition to the priority action substances under Ireland's surveillance monitoring programme. A further 11 substances were also selected for a supplementary list and monitoring as part of the operational monitoring programme. The design of the monitoring programme and the selection of these substances is explained in more detail in section 4. The preliminary results from the WFD surveillance network dangerous substances monitoring are examined below in section 2.2.2.

2.2.2 WFD Surveillance Network Dangerous Substances monitoring

The Environmental Protection Agency (EPA) began dangerous substances monitoring under the WFD in July 2007. To date the results available from this monitoring exercise include partial data for July to December 2007 with concentrations for VOC's and the metals not yet available. There are approximately 250 river and lake sites in Ireland's overall surveillance programme; priority action substances and the relevant pollutants monitoring will be carried out over a three year cycle, with 90 sites nationally being tested in 2007.

Positive detections were noted for the substances shown below in Table 1 from the preliminary findings of this surveillance network monitoring.

Table 1: Numbers of Positive detections for each substance from the surveillance monitoring network results

No	Substances	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total No. Of Findings
1	Anthracene	1	1					2
2	Atrazine	18	3	11	13	8	7	60
3	Di(2-ethylhexyl)-phthalate	14	10	9	21	15	9	78
4	Diuron	1		5	3		1	10
5	Fluoranthene	13	9	8	2	3	4	39
6	Isoproturon					4	11	15
7	Benzo[a]pyrene	20	15	4	6	5	17	67
8	Benzo[b]fluoranthene	7	6	2	1	1	1	18
9	Benzo[k]fluoranthene	4	3		1			8
10	Benzo[ghi]perylene	8	7		1	2	1	19
11	Indeno[1,2,3-c,d]pyrene	5	4		1	1		11
12	Simazine	30	18	23	31	22	20	144
13	Mecoprop	12	12	10	12	6	5	57
14	Glyphosate	9	8	8	8	2		35
15	Cyanide	6	13	13	46	16	23	117

In five out of six of the months (that monitoring data is available for) the most frequently found substance was simazine however all these findings were below the proposed EQS for simazine of 1µg/L. Cyanide was also found frequently however again all these findings were below the proposed EQS for cyanide of 10µg/L. The overall results were compared with the EU draft priority substances EQSs and the proposed WFD EQSs (Environmental Protection Agency, 2007a) that have undergone consultation and are due to be made into regulations. The results were compared with both the Annual Averages (AA) and the Maximum Allowable Concentrations (MAC). The MACs were not exceeded in these preliminary results. This comparison (Table 2) shows the substances to date that may exceed the annual averages.

Table 2: Results above the proposed EQS

Substance	EQS AA	July	Aug	Oct	Nov	Dec
	µg/L	All Ranges and Results are in µg/L				
Sum of Benzo[b]fluoranthene + Benzo[k]fluoranthene	Sum= 0.03	3 results are above the proposed EQS	2 results are above the proposed EQS	1 result is above the proposed EQS		
		Range: 0.034-0.042	Range: 0.054-0.057	Result: 0.039		
Sum of Benzo[g,h,i]perlyene + Indeno[1,2,3,c,d]pyrene	Sum= 0.002	4 results are above the proposed EQS	8 results are above the proposed EQS	1 result is above the proposed EQS	2 results are above the proposed EQS	1 result ifs above the proposed EQS
		Range: 0.028-0.057	Range: 0.005-0.071	Result: 0.046	Range: 0.006-0.02	Result: 0.006
Di(2-ethylhexyl) phthalate	1.3		1 result is above the proposed EQS			
			Result: 1.37			

Table 2 above shows the results from the surveillance sites for July to December that are above the proposed annual average EQSs and therefore may exceed the EQSs. These results are out of a total of 90 samples analysed. It should be noted that some of the results that are exceeding the EQS are just marginally exceeding the annual averages and a full set of data will possibly indicate that the annual averages are not exceeded. The Polyaromatic Hydrocarbons (PAH) found (that is the Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[g,h,i]perlyene Indeno[1,2,3,c,d]pyrene) are not manufactured substances but are ubiquitous. PAHs are by-products of combustion and therefore cannot be linked to a single source and it is therefore problematic to control. Di(2-ethylhexyl)-phthalate is found in plastics so is therefore also ubiquitous. The Di(2-ethylhexyl)-phthalate result in August 2007 is just above

the annual average and is a once off to date, so it is therefore unlikely that the annual average will be exceeded when a full years analysis is available.

2.2.3 South Western River Basin District Municipal and Industrial Regulations study

The South Western River Basin District Municipal and Industrial Regulations study has carried out an investigation into the treatment and discharge of dangerous substances in wastewater treatment plants (WWTP) as part of their Industrial and Municipal Regulations Programme of Measures study (South Western River Basin District, 2006). The purpose of this study was to investigate the characteristics of discharges of treated effluent from urban WWTPs and in particular to sample, analyse and identify the presence of priority pollutants in effluents likely to impact the chemical or ecological status of receiving waters. There were two phases of analysis involved in this investigation. The following WWTPs were monitored in Phase 1: Bandon, Buttevant, Carrigrenan, Castleisland, Charleville, Moate, Tullamore, Ringsend and Roscommon. The study also investigated the effects of leachate from landfill on the presence of dangerous substances in WWTP's effluent.

The data from phase 1 indicates that metals were found generally in low concentrations below the proposed EQSs. (The EQS used to examine the monitoring results for Phase 1 were those used by Ireland's Dangerous Substances Expert Group for the screening study process). The organics, solvents and volatiles results were below the limit of detection for all the samples analysed in Phase 1. The majority of the Polycyclic Aromatic Hydrocarbons results' were also below the limit of detection. Flouranthene was found in levels above the EQS at one WWTP. It was noted that higher levels of dioxins and furans were detected in the WWTP that was receiving leachate. Di(2-ethylhexyl)-phthalate was found in each of the effluent samples in most cases above the EQS level that is proposed as a priority substance (COM (2006) 397 final).

Phase 1 was not conclusive so it was decided to roll out a second phase of monitoring. Phase 2 retained investigation of pesticides that were not detected in the samples that were taken during November. The absence of these pesticides was as expected as their use is seasonal and therefore sampling in spring/summer was recommended for the second phase of monitoring. The Phase 2 monitoring was planned to enable further characterisation of the impact of effluent from WWTPs accepting landfill effluent. Five WWTPs (discharging to freshwater) underwent further testing; three WWTPs which accept landfill leachate and two WWTPs which do not accept landfill leachate. WWTPs that underwent further monitoring were:

- Castleisland and Macroom (not accepting landfill leachate)
- Charleville, Nenagh and Tipperary Town (accepting landfill leachate)

A report from this further monitoring is currently being finalised (South Western River Basin District 2008). The Phase 2 study has highlighted the limitations of current analytical technologies in the identification of priority substances as often times the EQS was lower than the limit of detection.

Chloride was found in higher quantities in the effluent of plants receiving leachate. Mecoprop was the only pesticide found in the effluents analysed. It was found at low levels below the proposed EQS in the final effluent of the Nenagh, Tipperary and Charleville plants and in elevated levels in receiving waters at Charleville. Naphthalene was the only PAH found in this study, it was found at Tipperary WWTP in quantities below the EQS.

It was not possible from this Phase 2 analysis to establish a correlation between landfill leachate and the final effluent quality and subsequently the impact on the ecology of the receiving water as there were gaps in the chemical data in relation to the receiving water or in relation to the final effluent and it was therefore difficult to establish a correlation between a deterioration in the Q-values upstream and downstream of the treatment plants to final effluent quality. Further investigation has been recommended.

2.3 Update of Pressure Data Layers and GIS registers

During initial characterisation a number of dangerous substances related GIS layers were generated or made available to the River Basin Districts from a variety of sources. These included data on the location of industries, agriculture, forestry and aquaculture activities. Where possible, these pressure layers have been updated and incorporated into the dangerous substances inventories. For example, information on the finfish farms nationally formed part of a study into the use of dangerous substances in aquaculture. However, the Dangerous Substances Usage POMS study has not been able to improve the agricultural landuse information available to the River Basin Districts.

Data collection and update of pressure layers has also been supplemented by external studies. In particular, the South Western River Basin District updated the following datasets for use in the Municipal and Industrial Regulations study and also this dangerous substances study.

- IPPC licences discharging to sewer
- IPPC licences discharging to water
- Section 4 licensed industries
- Section 16 licensed industries
- Waste facilities

Further information will become available from ongoing projects a new forestry layer (FIPS 2007) is being updated by the Western River Basin Districts at present and will be finished in 2008. There is currently an investigation into mines being carried out by the EPA and the GSI jointly which will provide new pressure layers on existing and historic mine sites nationally.

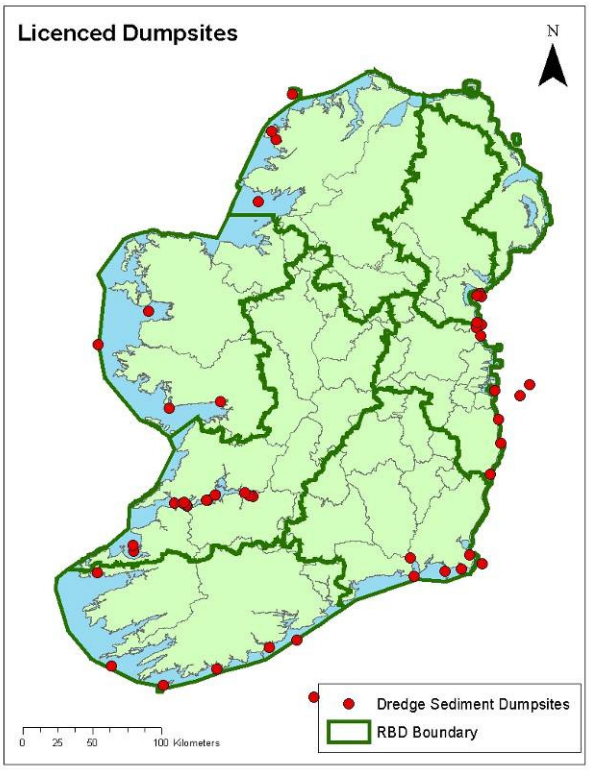
Landfills and waste sites were investigated for inclusion in this study. For the waste sites it was considered that dangerous substances are unlikely to be discharged from these regulated sites as substances are removed to other countries for treatment. These sites may still need further investigation in the future. The South Western River Basin District Municipal and Industrial Regulation Programmes of Measures was tasked with carrying out analysis of landfill leachate and its treatment in waste water treatment plants. Future investigation into the dangerous substances from landfill leachate is recommended.

A Code of Practice has been prepared by the EPA and sent with a circular letter to the local authorities requesting that they carry out risk assessments on unregulated landfills (Environmental Protection Agency, 2006). The Code of Practice was developed to ensure a consistent approach to environmental risk assessment by local authorities when assessing the environmental impact and remediation options for historic unregulated waste disposal sites. It also provides guidance on how to deal with illegal landfills that have come into being since the introduction of the waste licensing regime. These unregulated sites are a potential source of dangerous substances and should be investigated further.

2.3.1 Marine Institute Dredge Sediment Database

The Marine Institute have recently developed a dredge sediment database which this study populated with data from 29 current disposal licences. The spreadsheets contain results for moisture, granularity, metals (Arsenic, Cadmium, Copper, Mercury, Lithium, Manganese, Nickel, Lead, Zinc), Polycyclic Aromatic Hydrocarbons (Acenaphthene, Acenaphythylene, Anthracene, Benzo(a)anthracene, Benzo(b)flourathene, Benzo(ghi)perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Flourene, Fluoranthene, Indeno(1,2,3–cd)pyrene, Naphthalene, Phenanthrene and Pyrene), pesticides (DDE, DDT, Dieldrin, HCH gamma, HCB and TDE) and PCB's. The Marine Institute will upload this information into their national database. In future the spreadsheet will be sent to ports as part of their application for dredge sediment disposal. This will facilitate annual national reporting to the OSPAR Commission on disposal of dredge material at sea. Map 1 shows the location of the licensed dumpsites nationally.

Map 1: Dredge sediment disposal sites



2.3.2 Waterways Ireland use of pesticides

Waterways Ireland are responsible for Ireland's inland navigations. Waterways Ireland applies pesticides directly to the centre of the canals to ensure that they remain navigable. Waterways Ireland has stated that it applies two pesticides to the canals. These are as follows: Casoron (Active Ingredient- Dichlobenil (CAS number- 1194-65-6)) and Roundup (Active Ingredient- Glyphosate (CAS Number-1071-83-6)). Waterways Ireland has estimated it will use 23 tonnes of aquatic herbicide Casoron in 2008, the active ingredient of which is dichlobenil (2.6 – dichlorobenzonitrile) in a 6.75% formulation. The recommended application rate is 140 kg per 1 km of affected canal. Dichlobenil was on the dangerous substances screening programme monitoring list, but has not been brought forward for WFD monitoring as it was not found in significant quantities. Dichlobenil will however, remain on a reserve list and will be reviewed for future river basin planning monitoring cycles.

Waterways Ireland also use glyphosate as a herbicide. Between March 2007 and October 2007 seventy litres of undiluted Roundup (glyphosate) was used. The dilution factor when the glyphosate is applied is of the order of 50:1. Glyphosate is on Ireland's specific relevant pollutant monitoring list. Glyphosate was added to the list as it was found in significant quantities in the screening monitoring programme. Roundup is a pesticide that has many sources of use such as agriculture, horticulture etc. An EQS is proposed for

glyphosate from the EQSs that were put out for consultation in 2007 (not yet finalised). The proposed EQS for glyphosate is 65µg/l for freshwater (annual average). There may be implications for Waterways Ireland practices when the EQSs are made into regulations if Waterways Irelands use results in an exceedance of the EQSs. Waterways Ireland has stated that they are introducing a 25% reduction in the use of pesticides in summer 2008. Guidance will be published by the European Commission on mixing zones in relation to the priority substances. This information when it is available may apply to Waterways Ireland use of pesticides. Currently all pesticide use is controlled through a regulatory framework which is implemented by the Pesticide Control Service in Ireland.

2.3.3 Industrial Datasets

Datasets have been collated by the project team for use in the development of inventories and risk assessment. The main focus of this study has been on the manufacturing and processing industry's use and discharge of dangerous substances. The information collated by the study on these discharges includes the following datasets and information sources:

- European Pollutant Emission Register (EPER)
- DEFRA spreadsheet
- EPA Annual Environmental Report database
- Wexford IPPC audit
- IPPC Questionnaire database
- Commission -Source Identification and Emission Controls

European Pollutant Emission Register (EPER)

EPER is the European Pollutant Emission Register, the first European-wide register of industrial emissions into air and water, which was established by a Commission Decision of 17th July 2000. The Office of Environmental Enforcement provided a database of information on dangerous substances discharges prepared as part of the EPA's EPER obligations. It provides information on discharges from Integrated Pollution Prevention Control (IPPC) licences to water and to air for the year 2004.

DEFRA spreadsheet

Spreadsheets were compiled from the UK Department of Environment Food and Rural Affairs (DEFRA) industrial uses of dangerous substances contaminated land publications (Department of Environment, 1996). The industry profiles provide information on the processes, materials and wastes associated with the individual industry types. The wastes associated with individual industries were reviewed and summarised into a spreadsheet. This spreadsheet can be filtered per industry type, to allow viewing and extraction of the possible chemicals that would be used in a particular industry type. These sources of use spreadsheets indicate the potential dangerous substances associated with various industrial/manufacturing activities and identify typical substances discharged.

EPA Annual Environmental Reports database

Information from IPPC Annual Environmental Reports (AER) was provided by Dr. David Styles a Research Fellow with the EPA and Trinity College Dublin. This information was limited however to the Energy and Pharmaceutical IPPC licensed industries.

Wexford IPPC audit

A trial audit of IPPC licensed industries in the South Eastern and Shannon River Basin Districts was undertaken in 2003 to investigate the extent of usage of priority action substances, relevant pollutants and general components by major industries. This audit involved a desk top study of a sample of licensed sites selected to represent the range of industrial activities which occurred in either district. The industries were categorised using the NACE code scheme which is a classification of economic activities in the European Community. All IPPC licensed industries in both river basin districts were examined and given an individual NACE code depending on their type of activity. The licence of at least one industry from each NACE category was examined to establish the type of substances which could potentially be discharged or lost from the various industry categories. The study determined that the sample of 58 industries from the South Eastern and Shannon River Basin Districts used 16 priority substances listed in Annex X of the WFD. Several relevant pollutants are also in widespread use within the districts. The survey was used to verify industrial profile and questionnaire responses.

IPPC Questionnaire database

The focus of this dangerous substances usage study was on Ireland's manufacturing and processing industry's discharges. The major industries discharging directly to water or to the sewer have IPPC licences. All related operations that the licence holder carries out in connection with the activity are controlled by this licence. Before a licence is granted, the licence holder must satisfy the EPA that the emissions from the activity do not cause environmental pollution.

A complete picture of the use of dangerous substances is not currently available. Under the Article 5 Characterisation Ireland was limited to calculations of nutrient discharges from industry. The EPA are now using an electronic reporting system and a national database of the AERs will be available from the reporting year of 2007 onwards.

Under this study industrial discharges were examined and IPPC licence holders were surveyed for information on their use and discharge of dangerous substances. A questionnaire was developed and sent to selected IPPC licence holders to establish an IPPC industries database of dangerous substances. The questionnaire is a tailored list of Ireland's priority action substances and relevant pollutants in the form of the European Pollutant Release and Transfer Register (E-PRTR) list which the industries are familiar with.

Additional substances that appeared on the questionnaire are grouped in accordance with type and use so that it was concise and easy to complete. The questionnaire was sent out by the Office of Environmental Enforcement (OEE), EPA. The questionnaire asked the IPPC licence holders to verify their usage of particular dangerous substances and the amount of substance used and discharged annually.

The questionnaire was sent to selected IPPC licensed industries for each NACE code. A NACE code is a unique 5 or 6 digit code that classifies economic activities or industries in the European Union. The selected industries that the questionnaire was sent to were selected in consultation with the EPA OEE. The chosen industries replies were then used as a representative for industries that hold IPPC licences with the same NACE Code. In this way a database of dangerous substances related to IPPC licences was developed. 146 questionnaires were sent out in January 2007. Follow up telephone calls were made to any IPPC licensees that did not return a completed questionnaire. Ultimately 93 IPPC licence holders replied. The list of industries contacted and those that replied is noted in Table 19, Appendix 1.

The information received in the questionnaires quantifies the dangerous substances used and discharged from the industries that it was sent to. A large number of industries stated in the questionnaire returns that they did not use or discharge any of the priority substances or relevant pollutants. The questionnaire was sent to each pharmaceutical industry. From the questionnaire results the industries that are more likely to use and discharge dangerous substances are the pharmaceutical industries. The results of the questionnaire for the different NACE Codes are tabulated in Tables 27 to 33, Appendix 1.

As part of this data collection process requests for information on dangerous substances usage were sent to local authorities, airports and Iarnrod Eireann. The response to these requests was poor. The local authorities do not collate records on their use of dangerous substances. The information provided by the airports was general information. It was noted that simazine and glyphosate are used for airfield grass management programmes. Both chemicals are contained in herbicides used by the grass contractors for the purposes of managing weeds on the taxiways and main runway. These pesticides are applied 3 to 4 times during the season (May to September). The use of de-icers may also be an issue that should be noted in any future study. There was no reply from Iarnrod Eireann.

Commission –Source Identification and Emission controls, Substances Measures and Source Screening sheets

These reports outline the basic approach used to identify significant sources, pathways and potential emission controls for the priority substances and the priority hazardous substances (Directorate General for Environment, 2005a). The source identification and emission control background document sets out the process of developing the substance source screening sheets and the substance measures sheets, the approach used to identify significant sources, pathways and potential emission controls for the priority

substances and priority hazardous substances - including phase-out cessation requirements. The document also provides an overview of already existing pollution control measures for priority substances in the EU. Substances source screening sheets (Directorate General for Environment, 2004a) and substance measures sheets (Directorate General for Environment, 2004b) are available for all priority substances on the European CIRCA (Communication and Information Resource Centre Administrator) website. http://forum.europa.eu.int/. The substances measures sheets investigate existing and future controls for priority substances under the WFD. The substances source screening sheets categorise different sources or pathways for each of the priority substances by using the following categories.

- Category 1: The available information indicates that the source/pathway contributes to the concentration of the substance in the aquatic environment, which may lead to a risk of failing to meet the objectives of the WFD.
- Category 2: All other sources and pathways that have not been identified as Category 1or 3, in particular those where insufficient information is available.
- Category 3: The available information shows that the source/pathway does not have a potential for the release of the substance directly or indirectly to the aquatic environment.

The potential sources/pathways of individual priority substances are identified in these sheets, with categorisation according to their likelihood of leading to failure of WFD objectives. These source and measures sheets were used to verify the data that was collated through the other sources of data.

2.3.4 REACH

REACH is a European Community Regulation on chemicals and their safe use (EC 1907/2006) that entered into force on 1st June 2007. It deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances.

The aim of REACH is to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. The REACH Regulation gives greater responsibility to industry to manage the risks from chemicals and to provide safety information on the substances. Manufacturers and importers will be required to gather information on the properties of their chemical substances, which will allow their safe handling, and to register the information in a central database run by the European Chemicals Agency (ECHA) in Helsinki. All substances manufactured or imported into the EU in quantities greater than one tonne per year must be registered with ECHA. ECHA will act as the central point in the REACH system: it will manage the databases necessary to operate the system, co-ordinate the in-depth evaluation of suspicious chemicals and run a public database in which consumers and professionals can find hazard information.

The Regulation also calls for the progressive substitution of the most dangerous chemicals when suitable alternatives have been identified. REACH applies to all chemicals, not just those used in industrial processes, but also to household products and those used in articles (unless specifically exempted).

In Ireland the Health and Safety Authority (HSA) has been appointed as the interim competent authority for REACH working closely with other state bodies and stakeholders to manage the implementation of REACH.

REACH puts responsibility on the individual industries to submit information to ECHA. The information that has been gathered for this dangerous substances usage study will be used in the interim and will go towards the development of the River Basin Management Plan. REACH provisions will be phased-in over 11 years. It is likely that more information on dangerous substances and their toxicity will become available through REACH.

2.4 Generation of Irish National Inventories

A detailed national inventory of the discharges of dangerous substances is not available to date for Ireland. This project has collated industrial datasets and inventories of dangerous substances (mainly herbicides and pesticides) in use by the forestry, agriculture and aquaculture sectors which go towards a national inventory of discharges of dangerous substances. The objective was to produce inventories which included information on:

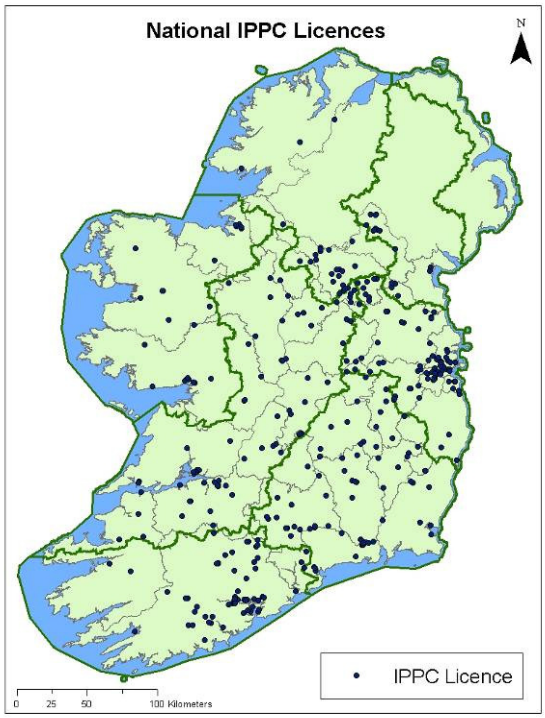
- type of pesticide
- period of use
- toxicity to fish and aquatic invertebrates
- area of use or location (where available).

The project was unable to produce some of the data required to produce concise inventories leaving gaps in information, for example more detailed mapping of agricultural landuse at townland scale will improve the inventories of pesticide application.

2.4.1 Irish industrial inventory

The focus of this dangerous substances usage study was on Ireland's manufacturing and processing industry's discharges. IPPC licence holders were surveyed for information on their use and discharge of dangerous substances. A questionnaire was developed and sent to selected IPPC licence holders to establish an IPPC industries database of dangerous substances. The results of this questionnaire (tabulated in Tables 27 to 33 Appendix 1) give an indication of the priority substances and relevant pollutants used and discharged in Ireland for the particular NACE Codes. Map 2 below shows the IPPC licences nationally. A selection of these IPPC licences were surveyed to establish the priority substances and relevant pollutants in use and discharged. The discharge information was also used in the development of the risk assessments as discussed in section 3.

Map 2: National IPPC licences



The results from the questionnaire show that the substances that the industries stated that are in use do not always correlate with the substances that the industries have discharge information for. The questionnaire results that stated the industry uses but does not discharge the substances may possibly be explained as follows:

- the substances used were treated prior to discharge to water or to sewer,
- dichloromethane and toluene were used and discharged in emissions to air rather than discharges to water or sewer,
- the substances that are noted to be used may be used in the preparation of products from that industry or used in closed systems and therefore may not be discharged as the substance is either used in the processes or in the production of a product from that industry,
- the substances that are used are treated offsite by contractors where the chemicals are either recycled or treated rather than being discharged onsite.

The questionnaire results that stated the industry discharges but does not use the substances may be explained as follows:

- the substances that are discharged may be by products and therefore are not noted to be used,
- the heavy metals that are discharged are as a result of contact with stainless steel pipes and copper vessels and not as a result of the use of heavy metal compounds,

- the mining industries noted that the metals were not used in the process but were generated as a result of the mining process.

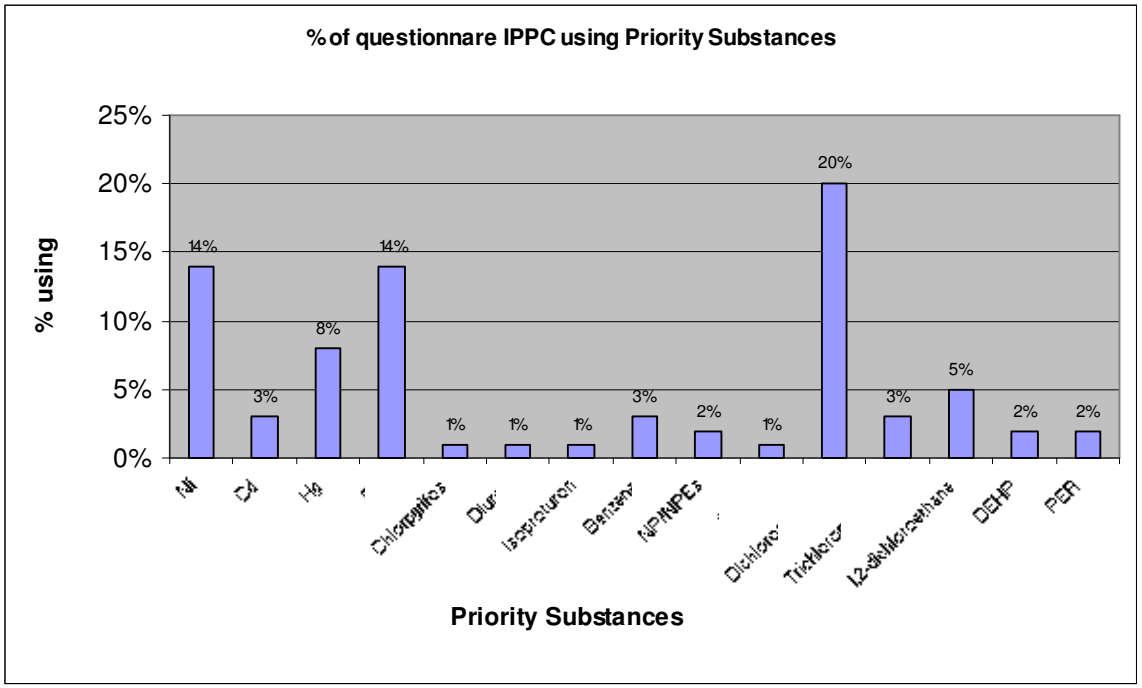
The review of the IPPC licences as discussed in section 5.1 should take this into account as the substances that the industries have noted that they are using should form part of their AER monitoring schedule.

The data from the questionnaire is a subset for the complete IPPC licences data. The questionnaire was sent to all the chemical industries and a representative from each of the other industrial sectors that come under the IPPC licensing.

The questionnaires were sent to a subset of the IPPC licences nationally so representing the data as complete national quantities with the data that has been compiled from the questionnaire is not possible. Taking this into account the questionnaire results are presented in the following way:
For each substance the number of times an industry stated that they either use or discharge that substance is presented as a percentage of the number of replies for the questionnaire.

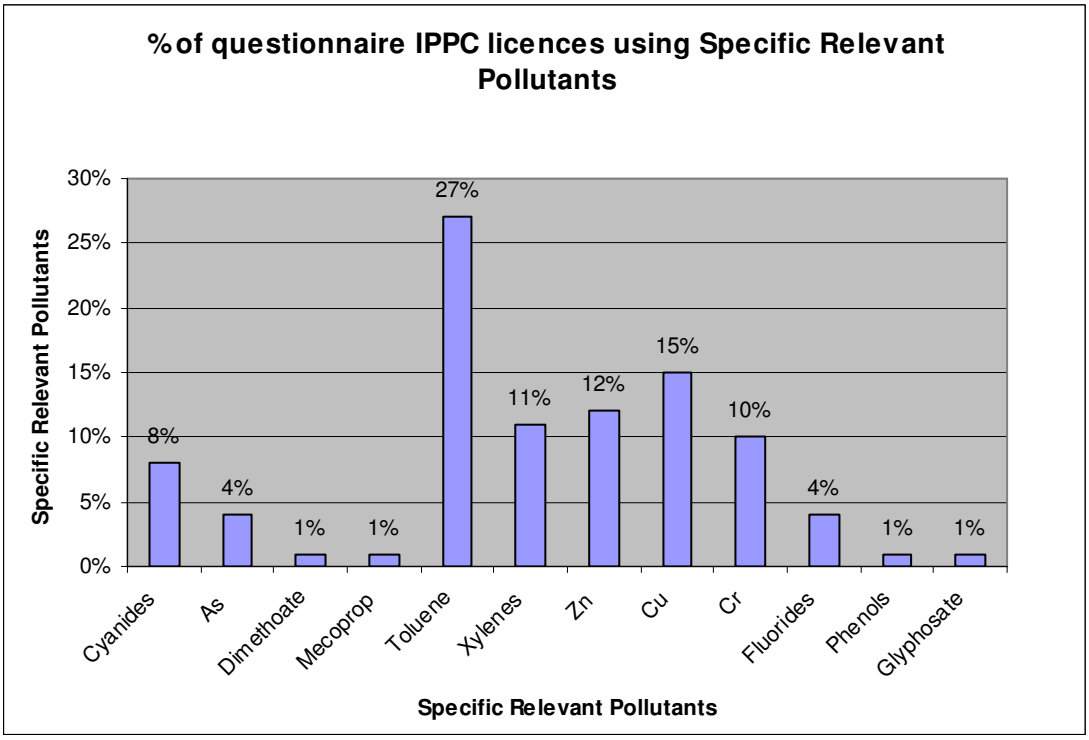
The results from the questionnaire that was sent to IPPC licence holders show that 15 of the 41 priority substances are in use in the IPPC licences that returned the questionnaire.

Figure 1: The percentage of IPPC licences using priority substances from the questionnaire returns.



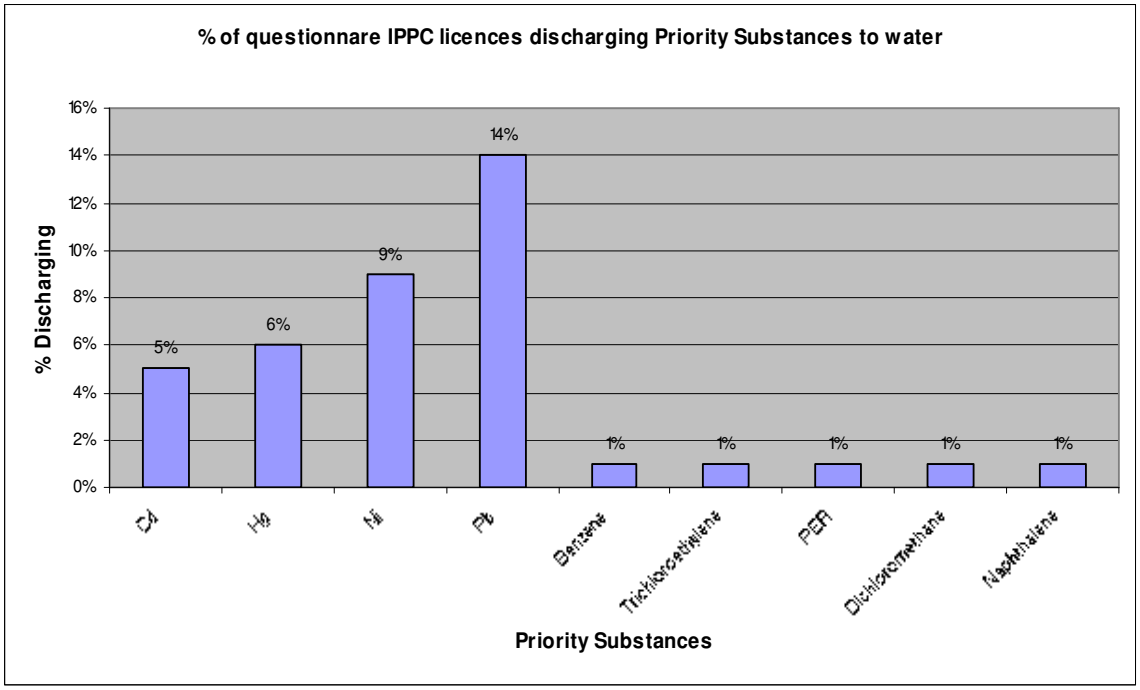
Cadmium and mercury were noted to be the priority hazardous substances that the IPPC licences recorded as substances that are in use in IPPC licensed industries. Dichloromethane, lead, nickel, mercury and 1,2-dichloroethane were the priority substances noted to be used in 5% or more of the questionnaires returned.

Figure 2: The percentage of IPPC licences using specific relevant pollutants from the questionnaire returns



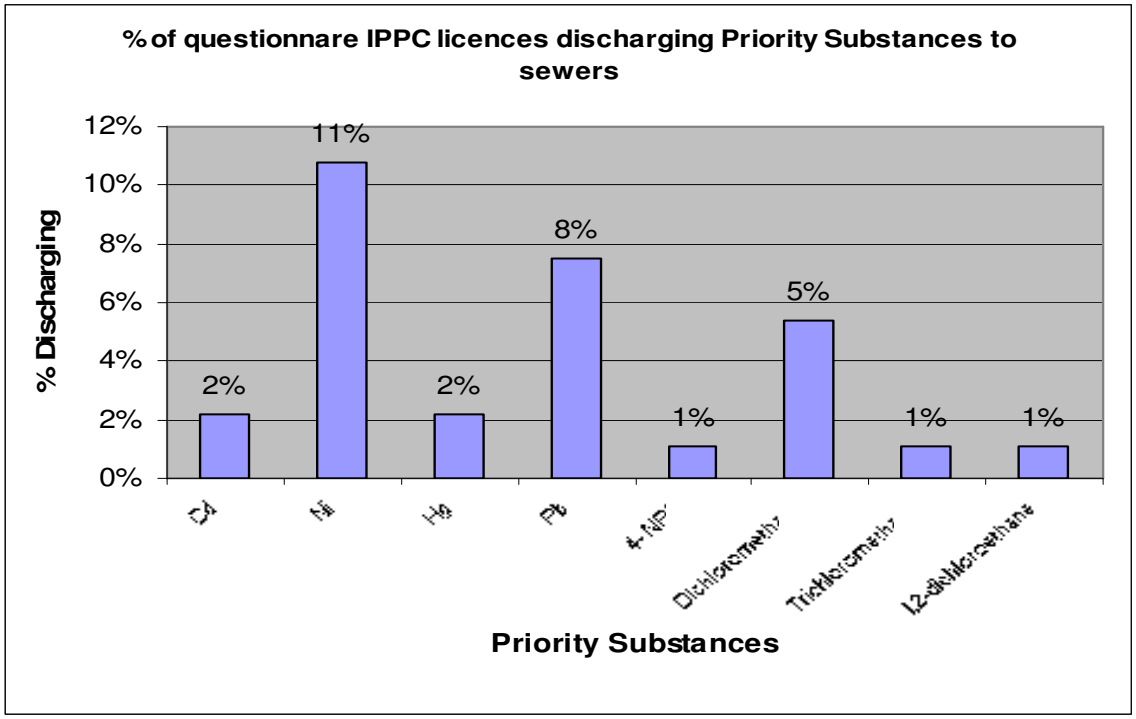
The specific relevant pollutants in figure 2 above are the specific relevant pollutants that had EQSs proposed for them in the classification consultation (Environmental Protection Agency, 2007). Twelve of Ireland's specific relevant pollutants were noted to be in use from the questionnaire results. Toluene, copper, zinc, xylenes, chromium and cyanide were the specific relevant pollutants that were noted to be used in 5% or more of the questionnaires returned.

Figure 3: The percentage of IPPC licences discharging priority substances to water from the questionnaire returns



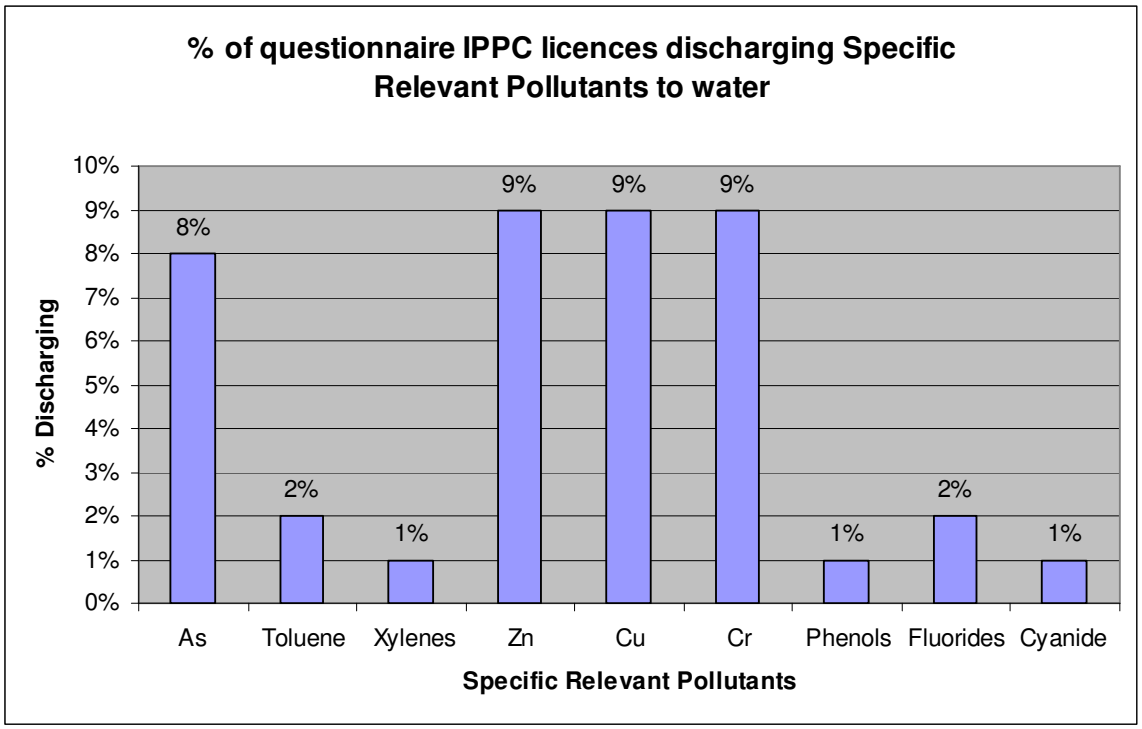
There were nine priority substances noted to be discharged *to water* from the IPPC licences that returned the questionnaire. Of these nine priority substances, cadmium and mercury were the priority hazardous substances noted to be discharged. Lead, nickel, mercury, and cadmium were the priority substances noted to be discharged to water in 5% or more of the questionnaires returned.

Figure 4: The percentage of IPPC licences discharging priority substances to sewers from the questionnaire returns



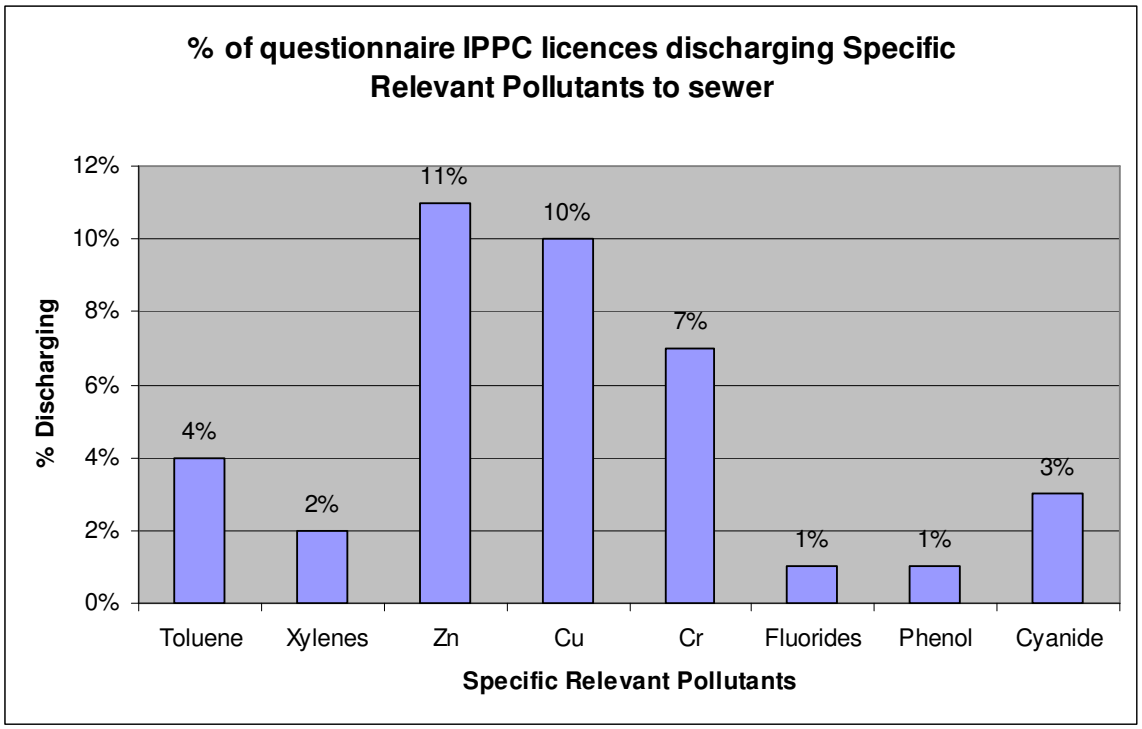
There were eight priority substances noted to be discharged *to sewers* from the IPPC licences that returned the questionnaire. Of these eight priority substances, cadmium and mercury were the priority hazardous substances noted to be discharged. Nickel, lead and dichloromethane were the priority substances noted to be discharged to sewers in 5% or more of the questionnaires returned.

Figure 5: The percentage of IPPC licences discharging specific relevant pollutants from the questionnaire returns to water



There were nine specific pollutant substances noted to be discharged *to water* from the IPPC licences that returned the questionnaires. Zinc, copper, chromium and arsenic were the specific relevant pollutants noted to be discharged to waters in 5% or more of the questionnaires returned.

Figure 6: The percentage of IPPC licences discharging specific relevant pollutants from the questionnaire returns to sewer



There were eight specific pollutant substances noted to be discharged *to sewer* from the IPPC licences that returned the questionnaire. Zinc, copper and chromium were the specific relevant pollutants noted to be discharged to sewers in 5% or more of the questionnaires.

The candidate relevant pollutants substances that were noted to be discharged to water from the questionnaire results are listed in Table 3. The relevant pollutants that were selected to be monitored under the WFD surveillance network are also noted.

Table 3: Candidate relevant pollutants noted from questionnaire that are discharged *to water*

Candidate relevant pollutants noted from questionnaire that are discharged to water	Candidate relevant pollutants monitored as WFD parameters
Antimony	X
Arsenic*	X
Barium	X
Benzylchloride (Alpha-chlorotoluene)	
Beryllium	
Boron	X
Chromium*	X
Cobalt	X
Copper*	X
Cyanide	X
Ethyl benzene	
Fluorides*	X
PCDD + PCDF (dioxins + furans)	
Phenols*	X
Selenium	X
Silver	
Thallium	
Tellurium	
Titanium	
Toluene*	X
Vinyl chloride	
Xylenes*	X
Zinc*	X

* Specific relevant pollutants proposed in June 2007 (Environmental Protection Agency, 2007)

2.4.2 Future development of industrial inventories

Under the European Pollutant Release and Transfer Regulation (E-PRTR) (EC) No 166 / 2006 an electronic tool has been developed by the EPA to collate the IPPC licences' Annual Environmental Reports (AER) along with the E-PRTR data.

The E-PRTR project is required to provide the EPA, as competent authority, with the capability of reporting to the EU in June 2009 the required emissions and waste transfer information for Ireland based on the 2007 reporting year.

An electronic reporting system has been prepared, it takes the form of an excel webform which each licensee / respondent will download from a dedicated website, fill in and return. A series of automatic and manual verification steps, with return to licensees for resubmittal, will guarantee full data quality. This electronic system went live in March 2008. Training took place across the country with the IPPC licence

holders in the first quarter of 2008 and the system will be used for the collation of AER and E-PRTR data from the 2007 reporting deadline of 31st March 2008.

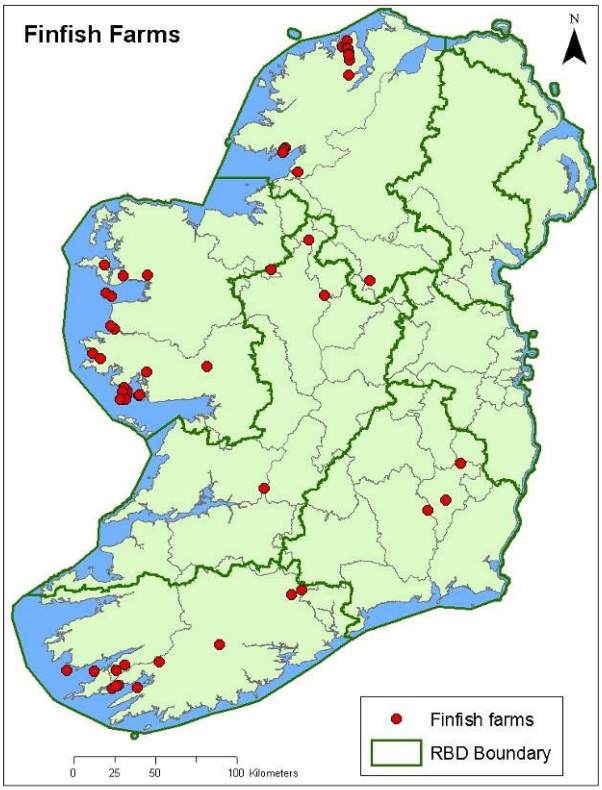
The information generated from this electronic tool will go a long way towards the development of future IPPC licence inventories of dangerous substances. For this current study some information from IPPC AERs was provided by Dr. David Styles a Research Fellow with the EPA and Trinity College Dublin. This information was limited however to the Energy and Pharmaceutical IPPC licensed industries. Similarly the implementation of REACH should provide information on the use of dangerous substances by industries.

2.4.3 Aquaculture

It was noted that aquacultural use of dangerous substances was a national data gap. The information required included the substances used in aquaculture, the quantities of substances used, the toxicity of the substances used and the sources of use (i.e. the location of the farms). The Marine Institute was commissioned by the study to investigate the medicines used for sea lice treatment, antibiotics and antifoulants in aquaculture and produced a report in March 2007 on the dangerous substances used in Aquaculture (Marine Institute, 2007).

The report found that the finfish aquaculture sector has contracted in Ireland over recent years. The major sector is Atlantic salmon (marine) production although the sector in Ireland is considerably smaller than the two other main salmon producing countries in Europe (Norway and Sweden). The most recent information from the Department of Agriculture, Fisheries and Food (DAFF) indicates 45 marine sites licensed for finfish aquaculture and 69 freshwater site licences. There are considerably less active sites and as an indicative number the Marine Institute fish health database lists 60 finfish aquaculture sites of which 27 are marine sites.

Map 3: National finfish farms



No priority action substances are used in aquaculture. The main medicinal treatments used in finfish aquaculture by volume (active ingredient) are antibiotics. However the pattern of medicinal use in finfish aquaculture changes frequently. The sea lice treatments currently used are slice (active ingredient emamectin benzoate), excis (cypermethrin), ektobann (teflubenzuron) and alphamax (deltamethrin). While the greatest overall quantity of sea lice treatment product used from 2004-2006 was slice, there is a relatively low proportion of active ingredient. Overall use of sea lice treatments as volume active ingredient during the 2004-2006 period were: Teflubenzuron > Emamectin > Cypermethrin > Deltamethrin.

The report also highlighted a changing usage pattern over the period of use examined, which is between 2004 and 2006. Deltamethrin only became available in 2005 and. Ektobann in 2006. The use of cypermethrin during the study period has greatly diminished.

Other treatments and substances used include the anti-fungicide bronopol, the anaesthetic tricaine methane sulphonate and disinfectants. Other substances discharged by fish farms include nitrogen, phosphorus and organic carbon associated with fish waste and feed. Antifoulants and feed are also a potential source of copper and zinc.

The Marine Institute reported information on the authorisation process for medicines for use in aquaculture and also on related monitoring programmes. Work is underway to develop an approach for implementing dangerous substance legislation with respect to finfish aquaculture in Ireland.

Table 4: Summary of medicines used in aquaculture and their application

Medicine	Active Ingredient	CAS Number	Freshwater /Marine/Both
Alphamax*	Deltamethrin	52918-63-5	Marine
Betamox LA	Amoxycillin		Freshwater
Ektobann	Teflubenzuron	83121-18-0	Marine
Excis	Cypermethrin	52315-07-8/ 66841-24-5	Marine
Florocol	Florfenciol		Both
Maracycline	Oxytetracycline hydrochloride		Both
MS 222	Tricaine methane sulphonate		Both
Pyceze	Bronopol	52-51-7	Both
Slice	Emamectin benzoate	137512-74-4	Both
Sulfatrim	Trimethoprim & sulphadiazine		Both

The data on the amounts of medicines used each year between 2004 and 2006 are tabulated in Table 20 to 22, Appendix 1. The report also investigated the methods of application of the substances used in aquaculture and the toxicity of each of these substances. This study is the first of its kind for aquaculture in Ireland. It is therefore not possible at this stage to make any conclusions on trends of substance use in aquaculture. The report also highlighted that the substances used for aquaculture change regularly and therefore a comparison from one year to the next may not be possible.

2.4.4 Forestry

Under the remit of the Western River Basin District Forest and Water Programme of Measures and Standards (POMS) study, an inventory of dangerous substances was developed. The information set out in the inventory is based on Coillte data. The report noted that forest cover now constitutes 10.1% of the national land cover, an area of 669,167 hectares (Western River Basin District, 2006). Both insecticides and herbicides are used in forestry practice in Ireland. The use of such pesticides is authorised by the Pesticide Control Unit (PCS) of the Department of Agriculture, Fisheries and Food, which is the Regulatory Authority with respect to plant protection products in Ireland and through the Forest Stewardship Council (FSC). The authorisation of use for such plant protection products is administered through Council Directive 91/414/EEC concerning the placing of plant protection products on the market.

The routine use of insecticides in forestry is mainly to protect Lodgepole pine (*Pinus contorta*), Scots pine (*Pinus sylvestris*), larch, Douglas fir and sitka spruce sites from the large pine weevil (*Hylobius abietis*). Application of the insecticide is generally made at two stages, pre planting (dipping) and post planting (spraying). Prior to planting bundles of plants are dipped into insecticide solution using a semi mechanical process. Coillte operates two facilities for this purpose, at Killygordon in County Donegal and at Ballintemple in County Carlow. Pre dipping reduces the requirement for spray application in the field. Spray application in the field is targeted at the young trees with pesticide being sprayed directly onto the tree stem, the site of weevil attack.

The Coillte data shows that the insecticide used for the control of the pine weevil is cypermethrin, a synthetic pyrethroid. (Western River Basin District, 2006). The common substances used previously to control the pine weevil included permethrin and alpha-cypermethrin, the latter is still in use in some areas. Herbicides are used to control weeds which are the most common and persistent threat of young tree crops. The principle herbicide used is glyphosate. Herbicides are used by both the state and private sector and are particularly important for control of weed growth in broadleaf plantations in the early years. The list of pesticides that were used by Coillte for protection of forested areas is tabulated in Table 5.

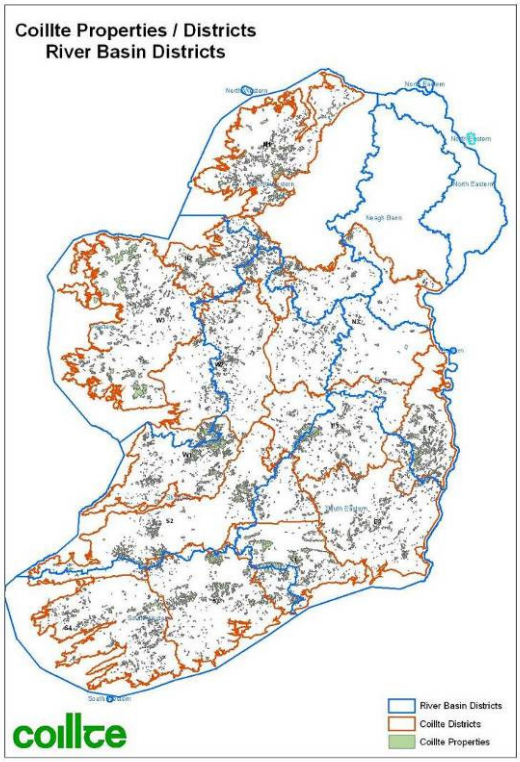
Coillte provided information on the forestry covered areas nationally. Map 4 shows the areas of forested land owned by Coillte. Coillte divides the country into districts and the data provided by Coillte gives the use of pesticides in these Coillte districts. The pesticide usage information for the Coillte districts is tabulated in Table 23, Appendix 1.

Table 5: Coillte pesticide usage by type.

Type	Active ingredient	Product	Amount of active ingredient (g/l)
Insecticide	alpha-cypermethrin	Agromethrin	40
Insecticide	alpha-cypermethrin	Bestseller	100
Insecticide	Cypermethrin	Forester	100
Insecticide	Carbosulfan	Marshal suSCon granules	10%*
Herbicide	Asulam	Asulox	400
Herbicide	Atrazine	Atrazine	500
Herbicide	Glyphosate	Roundup	360
Herbicide	Glyphosate	Biactive	360
Herbicide	Glyphosate	No-Mix Hilite	144
Herbicide	Imazapyr	Arsenal	250
Herbicide	Triclopyr	Garlon 2	240

*applied as a solid

Map 4: Coillte properties/ districts



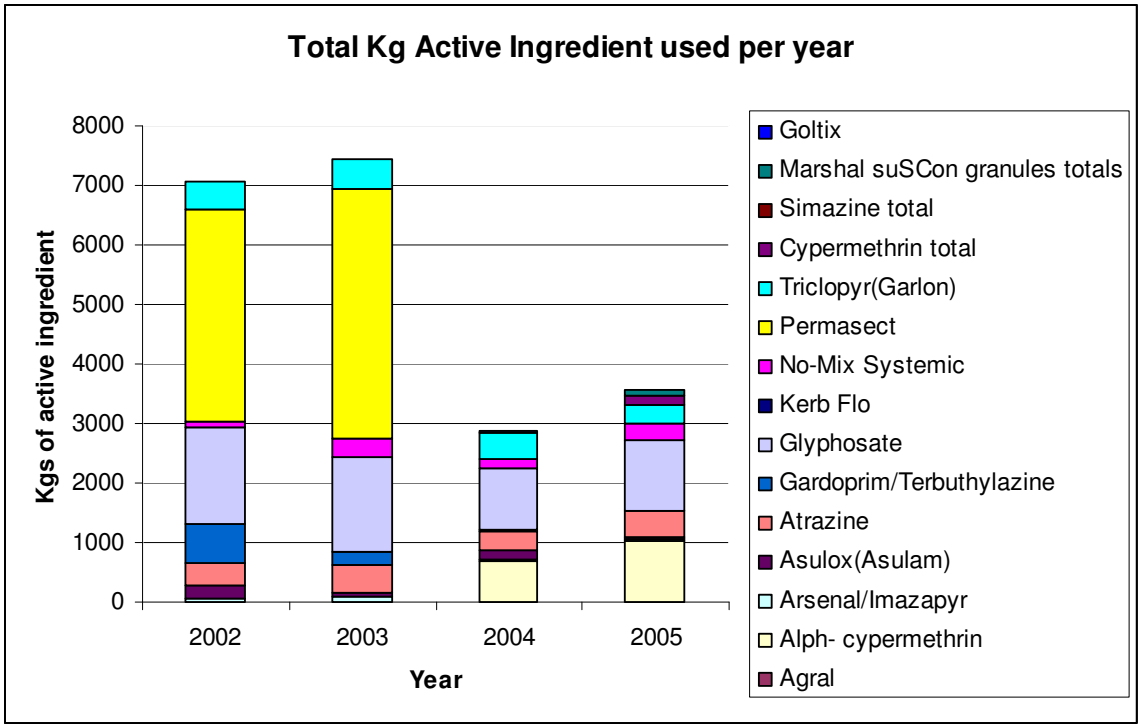
The Coillte Forest management districts are as follows in Table 6. For each of these management districts there is a District Strategic Plan which sets out the policy and longterm vision for the management of these areas. These plans include a chemical usage strategy. The plans state that there has been a reduction in pesticide usage in the Coillte districts since the late 1990s and the districts are working towards having the lowest level of pesticide usage possible for best forest management practice (Coillte, 2006).

Table 6: Coillte Forest Management Districts

Code	Coillte Forest Management District
E1	Dublin/Wicklow
E2	Southeast Counties
E3	Midlands
S1	South Tipperary/Waterford
S2	Lower Shannon
S3	Cork
S4	Southwest Peninsulas
W1	Clare/South Galway
W2	East Galway/Roscommon
W3	Connemara/Mayo
N1	Donegal
N2	Sligo/Leitrim
N3	Lakelands

Figure 7 shows the total Kgs Active ingredient used for the years 2002 to 2005. There is a downward trend between 2002 and 2004 with a slight increase for 2005. Figure 7 also shows the changing profile of the substances used between 2002 and 2005.

Figure 7: Total Kgs of active ingredients used by Coillte from 2002 to 2005



The decline in use of pesticides by Coillte over the period is due to a combination of the following reasons;

- There has been a drop in use or elimination in use of certain pesticides during the period. The main drop in usage occurred between 2003 and 2004. Between those two years, permethrin and

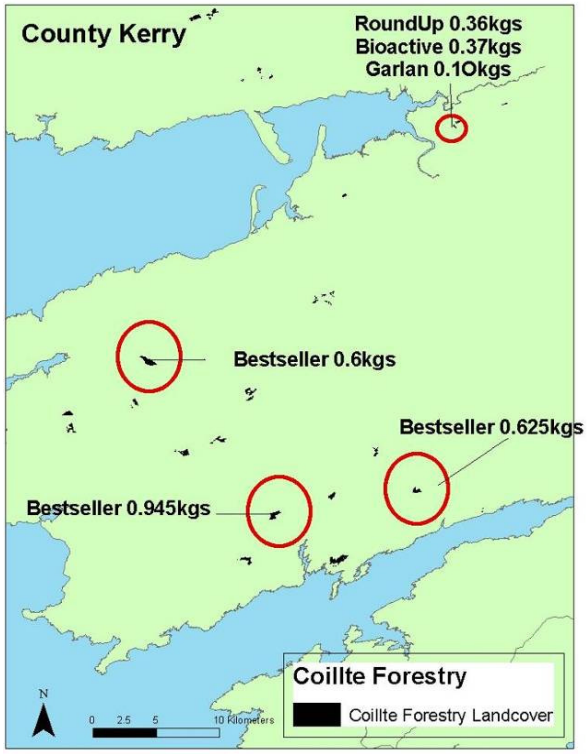
terbuthylazine use dropped to almost zero while use of atrazine, triclopyr and glyphosate also declined.

- These are real reductions as the level of planting carried out by Coillte remained almost constant (at between 10,000-11,000ha) between 2002 and 2004. There was a significant drop in planting in 2005 (down to 8,795ha), due mainly to a drop in the level of restocking in that year. The main reason for the increase in usage between 2004 and 2005 seems to be due to an increase in glyphosate use between the two years.

The pesticides used were linked to Coillte forest parcels provided by Coillte and the information mapped on GIS. For each of the polygons of forested area, information on the products used in Kgs per hectare can be shown. The example map shows the forest cover for a part of County Kerry with some of the pesticide usage highlighted for particular polygons.

The dangerous substances expert group noted that the forestry inventory used product types rather than actual active ingredients. The data the Western River Basin District had received from Coillte was in this format and therefore lent to the inventory using the product names. It may be preferable in the future to advise bodies such as Coillte to collate the information taking into account the active ingredients rather than the product name when collating data on pesticide usage.

Map 5: Example of Coillte usage of pesticides, Co. Kerry.



2.4.5 Agriculture

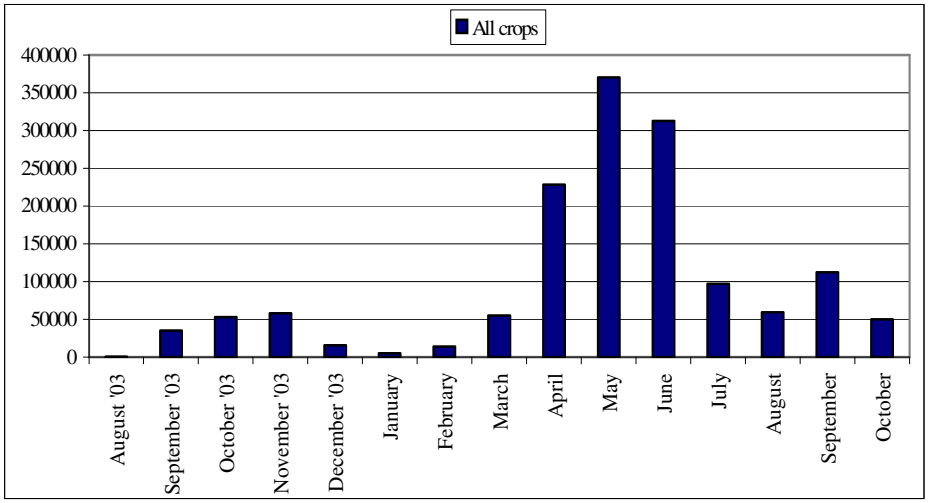
Detailed pesticide usage data is available on the use of dangerous substances from grassland, fodder and from arable crops. The pesticide usage data was prepared as part of the national Department of Agriculture, Fisheries and Food Farm Pesticide Surveys (Grassland and Fodder Crops 2003 and Arable Crops 2004) (Department of Agriculture and Food 2003 and 2004). The data from these studies are tabulated in Tables 24 to 26, Appendix 1.

The grassland, fodder and arable pesticide usage data need to be linked to agricultural land usage data. The landuse data that is currently available to the study is District Electoral Division (DED) and Corine based. The Corine data gives information on grassland and arable agricultural land use. Therefore the information from the pesticide usage reports for the different crops would have to be grouped together under arable and pasture from the Corine Layer. The Department of Agriculture, Fisheries and Food have landuse information on an Integrated Administration and Control System (IACS) database which is designed to administer various schemes run by the Department of Agriculture, Fisheries and Food. The database gives townlands as the landuse units. It is not yet possible to externally link the farming activities to land cover using this townland based information.

It is important to note for the dangerous substances monitoring the seasonal patterns of use of pesticides. Figure 8 shows the seasonal use of pesticides in quantities of active substances applied per month for arable crops harvested in 2004. The application of pesticides peaks in April, May and June.

Figure 8: Quantities of active substances applied per month

Source: Pesticide Usage Survey Arable Crops 2004, Department of Agriculture and Food



The greatest use of pesticides on grassland took place between May and August while use on fodder crops was highest earlier in the year - between March and June.

Five priority substances are used in the treatment of arable crops, grasslands and fodder crops (Table 7). There are seven of the specific relevant pollutants that EQSs have been proposed for, that are used as plant protection in grassland and fodder crops (Environmental Protection Agency, 2007). The use of these substances will have to be examined to achieve the WFD reduction targets and to ensure their use does not compromise WFD good status and EQS compliance.

Table 7: Priority substances and specific relevant pollutants used as plant protection for arable crops, grassland and fodder crops

Substances	Arable Crops	Grassland & Fodder Crops	WFD Surveillance Monitoring	EQS Proposed	Pesticide Control Service Regulation Status
Priority Substances					
atrazine		x	x	x	Use illegal from 31/12/07 under Pesticide Dir. 91/414/EEC
isoproturon	x	x	x	x	Use disallowed for product types 18* and 21* under Dir. 98/8/EC
trifluralin		x	x	x	Authorisations will be withdrawn shortly but the Commission has not published an official decision yet.
chlorpyrifos	x	x	x	x	Use disallowed for product type 18* under Dir. 98/8/EC
simazine	x		x	x	Use illegal from 31/12/07 under Pesticide Dir. 91/414/EEC
Specific Relevant Pollutants					
2,4-D		x	x	x	Registered Plant Protection Product
linuron	x	x	x	x	Registered Plant Protection Product
mecoprop		x	x	x	Registered Plant Protection Product
glyphosate	x	x	x	x	Registered Plant Protection Product
mancozeb	x	x	x	x	Registered Plant Protection Product
cypermethrin	x	x	x	x	Registered Plant Protection Product
dimethoate	x	x	x	x	Registered Plant Protection Product

**Product-type 18:* Insecticides, acaricides and products to control other arthropods

Products used for the control of arthropods (e.g. insects, arachnids and crustaceans).

**Product-type 21:* Antifouling products

Products used to control the growth and settlement of fouling organisms (microbes and higher forms of plant or animal species) on vessels, aquaculture equipment or other structures used in water.

Table 7 above shows the priority substances and specific relevant pollutants used as plant protection for arable crops, grassland and fodder crops. Since these surveys were carried out, atrazine and simazine have been banned from use. Isoproturon and chlorpyrifos have also been banned for use as insecticides and isoproturon has been banned from use as an antifouling agent. Trifluralin will also be withdrawn as noted. Seven of the specific relevant pollutants that have EQSs proposed are still in use in agriculture. The surveillance monitoring information may give some indication as to whether these standards will be exceeded. The surveillance information available to date shows that the specific relevant pollutants are present in low levels but the EQSs are not exceeded. The authorisation of isoproturon, trifluralin and chlorpyrifos may have to be examined to ensure that the EQSs are not exceeded and that good status is achieved.

Table 8: The total kgs of the priority substances and specific relevant pollutants in order of weight (kgs)

Active substance	Priority Substances	Specific Relevant Pollutants	Arable	Grassland	Total kgs
glyphosate		x	116731	93056	209787
mancozeb		x	157295	508	157803
isoproturon	x		107852	349	108201
mecoprop		x	8992	21761	30753
atrazine	x			24152	24152
2,4-D		x		23458	23458
dimethoate		x	17592	458	18050
simazine	x		5576	269	5845
chlorpyrifos	x		3852	337	4189
cypermethrin		x	2274	73	2347
trifluralin	x			653	653
linuron		x	190	45	235

Table 8 above shows the total kgs of the priority substances and the specific relevant pollutants used as noted in the Department of Agriculture, Fisheries and Food surveys on the use of pesticides for arable, grassland and fodder crops (Department of Agriculture and Food, 2003 and 2004).

The screening programme results show that mancozeb is the only substance for which the proposed EQS may be exceeded. The results show that over a 12 month period in 17 freshwater sites there was only one site where an exceedance may have occurred. The exceedance occurred at the River Barrow-Graiguenamanagh site. The results for this site were above the AA and MAC on one occasion. The MAC

exceedance was in May. The AA was exceeded in May and there was one other positive result in February. This area would be an agricultural area so it is a possibility that this exceedance was as a result of agricultural use in May. However Mancozeb was analysed with three other pesticides as part of the TNO monitoring (Zineb/Thiram/Maneb). So it is not exactly known that the exceedance is Mancozeb. The screening study programme was a once off programme of just 17 sites so the surveillance monitoring will give more information on the pesticides.

3.0 Risk Assessment

Under the Article 5 characterisation the industrial risk assessments for point sources assessed the compliance of the licence holder with the specifications of their licences. The discharge of dangerous substances was not one of the criteria used to assign risk. This study has gathered information and formed industrial inventories and from these inventories updated the risk assessments to take into account discharge of dangerous substances. Dangerous substances impact data is now also available that had not been available when the Article 5 risk assessments were carried out and this information was used to update the risk assessments to give a more representative assessment of the risks associated with dangerous substances.

Draft guidance on the development of a River Basin Management Plan states that classification will determine whether a waterbody passes or fails status. It will also identify the quality elements that have failed. The parameters monitored can indicate likely causes of failure. However, risk assessment is a critical support tool to identifying the pressure causing the status failure and predicting likely trends. The exercise of updating the dangerous substances risk assessments will therefore be a necessary tool for the development of the river basin districts management plans. (Department of the Environment, Heritage and Local Government, 2007)

The industrial risk assessment updates that were carried out under this study include:

- IPPC licences that discharge to water
- IPPC licences that discharge to sewer
- Section 4 licences

It was not possible at this stage to prepare a risk assessment for the Section 16 licensed industries as the database currently available for Section 16 licences is not complete. Of the 1188 Section 16 licences in the national dataset there are only grid coordinates for 242 of the licences in the national database. Also there are no grid coordinates for any of the Eastern River Basin District or Western River Basin District Section 16 licensed industries. The Section 16 licensed industries database was not included in the updated risk assessment as a result of these gaps in information.

3.1 IPPC Risk Assessment Methodology

For the IPPC licensed industries the following methodology was followed to produce risk assessments for discharges to water and to the sewer network;

- If a priority action substance or specific relevant pollutant discharge to water was indicated from the questionnaire results, from the EPER, AER and the Wexford IPPC audit that waterbody was "at risk" 1a.

- If an industry states that it discharges priority action substances or specific relevant pollutants in the questionnaire results all industries with the same NACE code that also discharge to water were given a risk score of 1a "at risk". If an industry that is discharging to sewer has stated that it is discharging priority action substances or specific relevant pollutants to sewer, it was taken that all industries in that NACE code were discharging the same substances. All industries in the NACE code include those industries discharging to water and to sewer, therefore were given a risk score of 1a "at risk". However in the case of chemical industries a questionnaire was sent to each of the licence holders and therefore the individual results were taken for the chemical industries rather than transferring the results across the NACE codes.
- If an industry type was a possible source of priority action substances or specific relevant pollutants as noted in the DEFRA spreadsheets a waterbody with that type of industry discharging to it was given a 1b risk score "probably at risk".

3.2 Section 4 Risk Assessment Methodology

The Section 4 database was collated by the South Western River Basin District as part of their Municipal and Industrial Waste Programme of Measures study. The Section 4 licensed industries with unmapped discharges were omitted from the assessment. The Section 4 licensed industries that discharge to groundwater were also omitted from the risk assessment. Industry types were assigned to as many as possible of the Section 4 licensed industries. The remaining list of Section 4 licensed industries where the industry is unknown were set aside until further information is available.

Data that was collated as part of the Dangerous Substances Programme of Measures study on the dangerous substances likely to be discharged from different industry types was used to assign risk where possible to the Section 4 risk assessment.

The DEFRA spreadsheets were also used to assign risk to additional industry types. Industries such as airports, asphalts, ceramics and transport facilities were assigned risk according to the DEFRA spreadsheets. The substances were broken into the categories as stated below according to the Guidance on the Reporting Sheets for the River Basin Management Plan (D'Eugenio, 2007). For each group of substances the risk was assigned as 1b "probably at risk" for the type of industries that had DEFRA industrial profiles that show that the industry is likely to discharge dangerous substances.

The questionnaire and the EPER results were used in a similar way as the DEFRA results however when an industry type had some corresponding questionnaire or EPER data that data was given a 1a "at risk" score.

The aquaculture[1] substances that were noted to be used in the Marine Institute aquaculture report (Marine Institute, 2007) were used to assign risk to the freshwater fish farm related sites that are Section 4 licensed industries. The substances that were noted to be used in the report were put into the groups as below and then a 1b "probably at risk" was assigned for these substances

Similarly for forestry the substances that were noted to be used in the Western River Basin District forestry report (Western River Basin District, 2006) were used to assign risk to the forestry Section 4 licensed industries. The substances that were noted to be used in the report were put into the groups as below and then a 1b "probably at risk" was assigned for these substances.

In the Section 4 database there are many licences for housing estates and public buildings such as government buildings, schools and religious orders buildings. The hospitals and nursing homes were removed from this list and set aside as further study is currently being undertaken in relation to hospitals. The EU environmental risk assessments, carried out under Directive 98/8/EC (Biocidal Products Directive) for Biocidal Product Type 18 (insecticides, acaricides and products to control other arthropods) specifically consider use in hospitals as a potentially significant emission source when evaluating household and professional uses of insecticidal substances. This is because the large size of hospitals means that they could have a potentially significantly larger area requiring use of insecticides than other types of buildings. This is currently undergoing further investigation by the Pesticide Control Service (PCS) and therefore the hospitals were removed from the Section 4 risk assessment and set aside until further information is available. The remaining licences for housing estates and public buildings were assigned a risk score of "not at risk" 2b.

The DEFRA profile for sewage and sewage farms put the WWTPs "at risk" 1a. The overall result took the worst case scenario. The results were tabulated and compared with the Article 5 RP4 (Point Source Section 4) risk assessment.

[1]While aquaculture is grouped with section 4s for this report, marine structures such as aquaculture installations are not covered by section 4 of the Water Pollution Act 1977. Freshwater sites require an effluent discharge licence from the local authority. Regulation of marine aquaculture operations in Ireland comes under the auspices of Department of Agriculture, Fisheries and Food.

Risk maps were produced to present the industrial risk assessments from IPPCs and Section 4 licensed industries. These maps were produced as set out in the format below according to the Commissions Guidance on the Reporting Sheets for the River Basin Management Plan. (D'Eugenio, 2007):

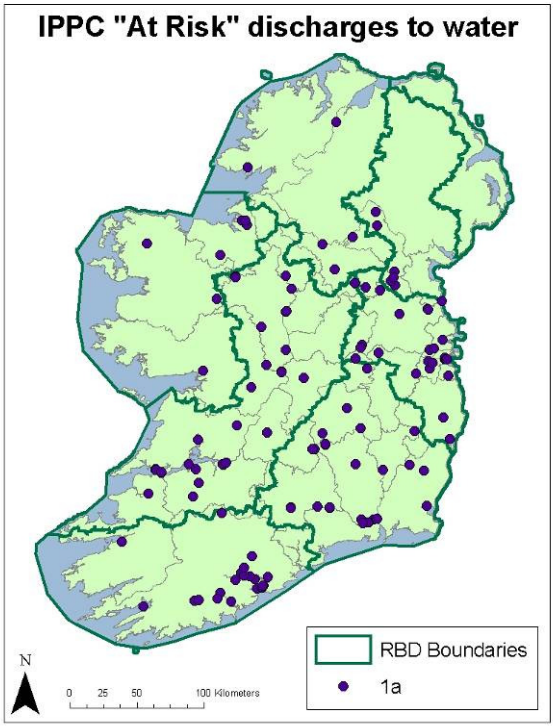
- Risk map for heavy metals[2]out of list of priority substances; (Map 7 below)
- Risk map for pesticides[3] out of list of priority substances;
- Risk map for industrial pollutants[4] out of list of priority substances; (Map 8 below)
- Risk map for other pollutants[5]; (Map 9 below)
- Risk map for specific relevant pollutants (18 pollutants prioritised on national level and EQSs proposed in consultation document (Environmental Protection Agency 2007 a) (Map 10 below).

In the maps below the IPPC licences are noted as points on the maps for display purposes but the risk assessments have been linked to waterbodies.

[2]Cadmium, lead, mercury, nickel.
[3]Alachlor, atrazine, chlorpyriphos, chlorvenfinphos, diuron, endosulphan, isoproturon, HCH, pentachlorobenzene, simazine, trifluralin.
[4]Anthracene, Benzene, C10-13-chloralkanes, Naphthalene, Nonylphenol, Octyphenol, Chlorinated organics (incl. SCCP, TRI, PER, DCM, Chloroform, 1-2- Dichloroethane...), PentaBDE, DEHP.
[5]DDT, HCB, HCBd, TBT, PAHs (including Flouranthene) PCP, TCB, drins.

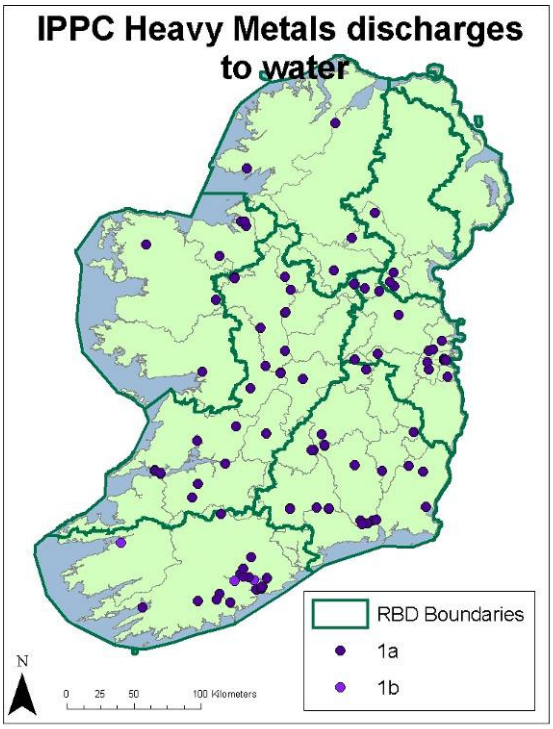
3.3 Industrial Risk Assessment Results

Map 6: IPPC "At Risk" Water



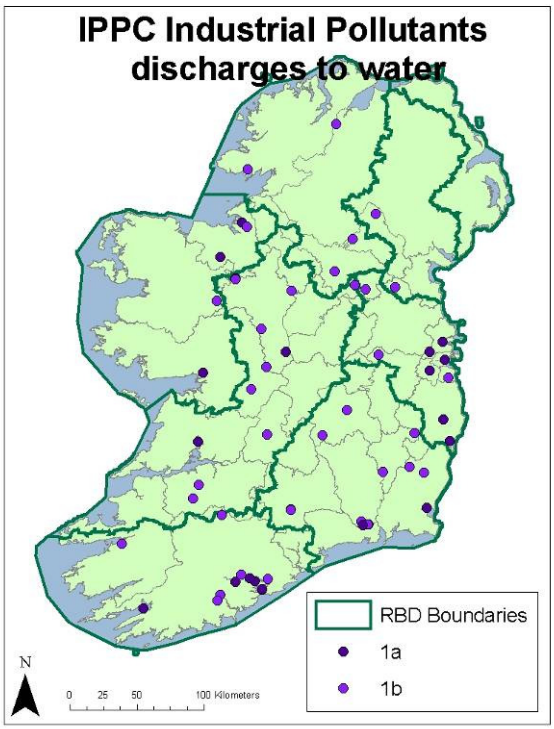
- There are 105 IPPC licences "at risk" 1a according to the new dangerous substances risk assessment out of a total of 170 IPPC. For the remaining 65 IPPC licenses there was no change from the Article 5 risk assessments.
- The Article 5 risk assessment stated that 25 were "at risk"1a, 4 were "probably at risk" 1b, 4 were 2a "probably not at risk", and 41 were "not at risk" 2b.
- For 31 of the IPPCs noted in this risk assessment there was no water body code.

Map 7: IPPC Heavy Metals Discharging to Water



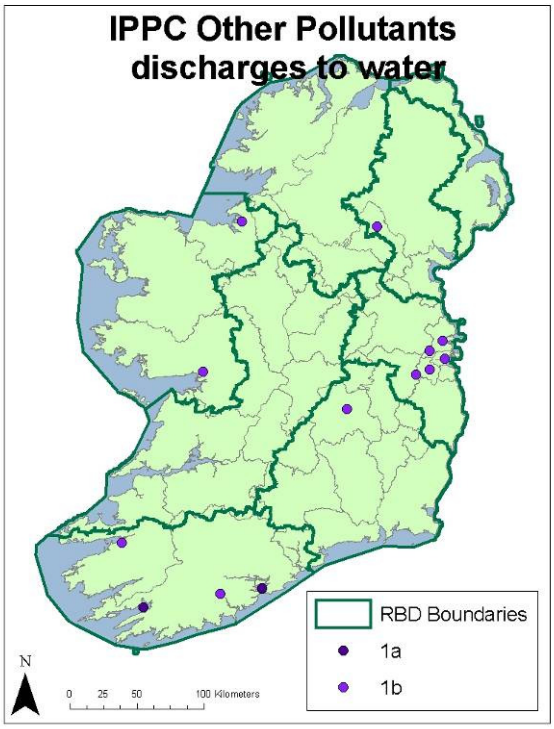
- 83 IPPC licences are "at risk" 1a of discharging heavy metals. 3 are "probably at risk" 1b of discharging heavy metals.
- These heavy metals are cadmium, lead, mercury and nickel. All four heavy metals were found to be discharged from IPPC licensed industries to water.
- The Article 5 risk assessment for these IPPC licences stated that 20 were 1a "at risk", 1 was 1b "probably at risk", 4 were 2a "probably not at risk" and 35 were 2b "not at risk".
- For 26 of the IPPCs noted in this risk assessment there was no water body code.

Map 8: IPPC Industrial Pollutants Discharging to Water



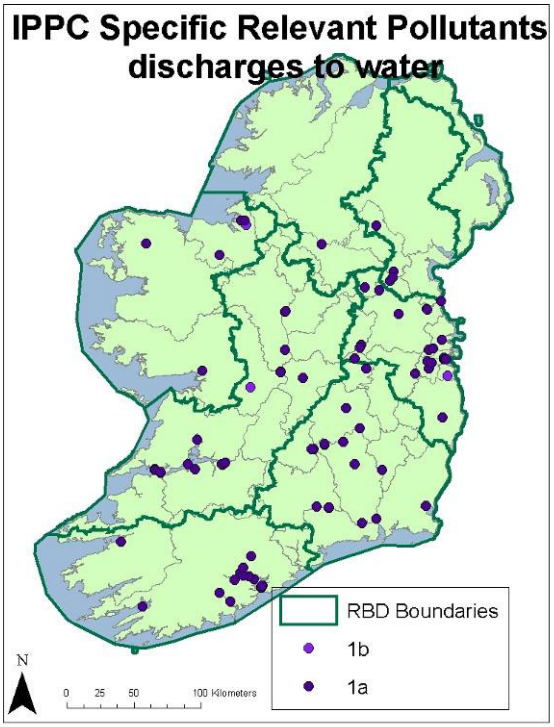
- 18 IPPC licences are "at risk" 1a of discharging Industrial pollutants. 38 are "probably at risk" 1b of discharging industrial pollutants.
- The Industrial Pollutants that were found to be at risk of being discharged from IPPC to water include: benzene, BDE, dichloromethane, naphthalene, nonylphenols, tetrachloroethylene (PER) and trichloroethylene.
- The Article 5 risk assessment for these IPPC licences stated that 16 were "at risk" 1a, 2 were "probably at risk", 2a were "probably not at risk" and 22 were 2b "not at risk".
- For 16 of the IPPCs noted in this risk assessment there was no water body code.

Map 9: IPPC Other Pollutants Discharging to Water



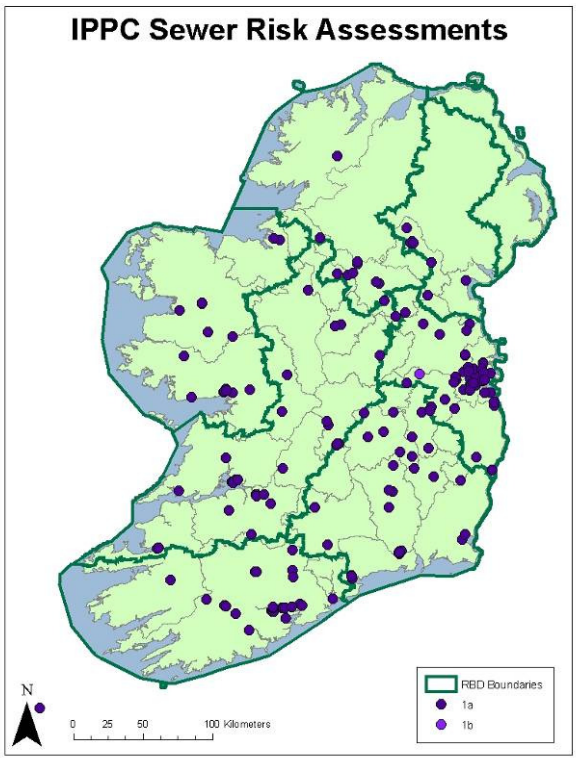
- 2 IPPC licences are "at risk" 1a of discharging other pollutants. 12 are "probably at risk" 1b of discharging other pollutants.
- The other pollutants that were found to be at risk of being discharged from IPPC to water were the polycyclic aromatic hydrocarbons.
- The Article 5 risk assessment for these IPPC licences stated that 3 were 1a "at risk" and 5 were 2b "not at risk".
- For 6 of the IPPCs noted in this risk assessment there was no water body code.

Map 10: IPPC Specific Relevant Pollutants Discharging to Water



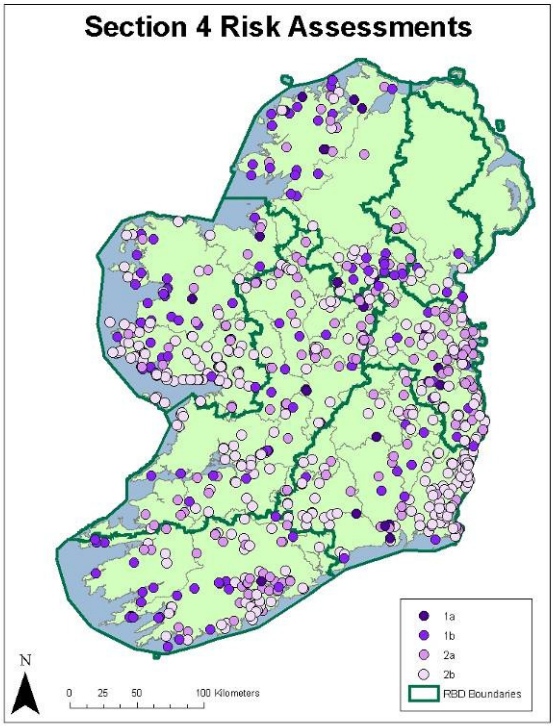
- 66 IPPC licences are "at risk" 1a of discharging relevant pollutants to water. 3 are "probably at risk" 1b of discharging specific relevant pollutants to water.
- The specific relevant pollutants that were found to be at risk of being discharged from IPPC to water were phenols, cyanide, chromium, arsenic, zinc, copper, fluorides, cyanide and benzene, toluene, ethlybenzene, and xylenes expressed as BTEX.
- The Article 5 risk assessment for these IPPC licences stated that 10 were "at risk" 1a, 4 were "probably at risk" 1b, 4 were 2a "probably not at risk" and 29 were 2b "not at risk".
- For 22 of the IPPCs noted in this risk assessment there was no water body code.

Map 11: IPPC "At Risk" Discharging to the Sewer Network



- Of the IPPCs that discharge to sewer 125 are "at risk" 1a of discharging heavy metals, 52 are "probably at risk" 1b of discharging pesticides, 1 are "at risk" 1a of discharging industrial pollutants, 91 are "at risk" 1a of discharging relevant pollutants and 180 in total are overall "at risk" and 2 are "probably at risk" 1b according to the new dangerous substances risk assessment.

Map 12: Section 4 "At Risk" of discharging relevant pollutants



- The results for the Section 4 risk assessments for dangerous substances show that of the 781 Section 4 licences in the national database 27 are "at risk"1a, 149 are "probably at risk" 1b, 200 are "probably not at risk" 2a, 405 are "not at risk" 2b.
- The Article 5 risk assessment for these Section 4 licensed sites state that 336 were "at risk" 1a, 130 were "probably at risk" 1b, 53 were "probably not at risk" and 20 were "not at risk" 2b.
- For 242 of the Section 4 Industries' noted in this risk assessment there was no water body code.

The South Western Municipal and Industrial Regulations Programme of Measures study is carrying out a point source discharge risk assessment and prioritisation that will complement the dangerous substances risk assessment updates.

3.4 Rivers Direct Impacts

Under the Article 5 Characterisation, risk assessments of dangerous substances impact data was not included for freshwaters, as there was limited data available at that time. The Rivers Impacts Dangerous Substances Risk Assessment update reviewed new monitoring data which has since become available. The following data has been reviewed:

- Local Authority Dangerous Substances Rivers Results (2001, 2001-2002 and 2002-2004)
- EPA Dangerous Substances Results (2002-2003)
- Screening Monitoring Freshwater Results (2005-2006).

The monitoring results from these programmes, were checked for compliance with the WFD EQSs which were proposed in June 2007 (Environmental Protection Agency, 2007). The Local Authority data has previously been reviewed by the EPA and for most of the cases where there were exceedances, a possible reason for that exceedance was given for example natural sources, agriculture, mining etc.

The rationale for the updated risk assessment is as follows:

Local Authority Dangerous Substances Rivers Results (2001, 2001-2002 and 2002-2004)

- Exceedances due to "testing process anomaly" and "natural sources" were given a 2a- "probably not at risk"
- If there was an exceedance and it stated that "further monitoring was required" then it was given a 1b "probably at risk"category
- All other exceedances were given a 1a- "at risk"

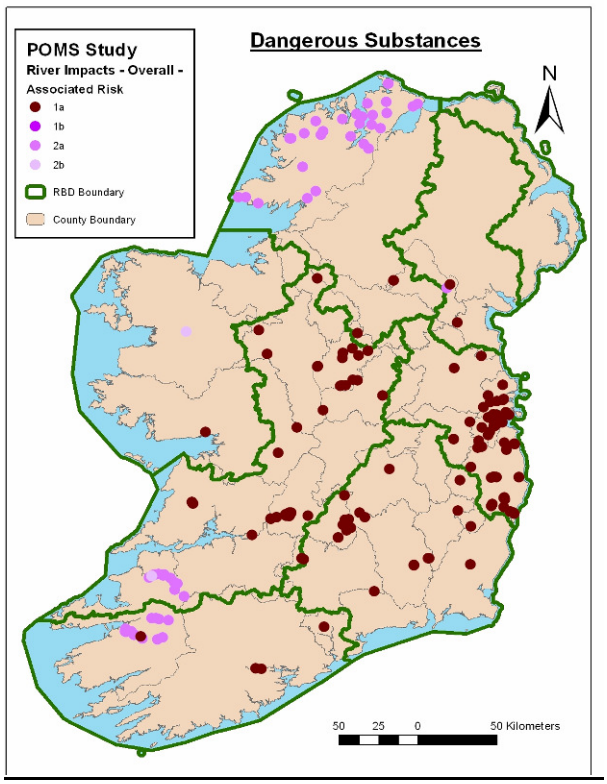
EPA Dangerous Substances Results (2002-2003)

- Any exceedance of WFD EQSs were given a 1a- "at risk"

Screening Monitoring Freshwater Results

- Any exceedance priority action substances and WFD EQSs were given a 1a- "at risk"

Map 13: Overall direct impacts risk assessment



- The results of the Rivers Direct Impacts Risk Assessment showed of the 618 waterbodies which had monitoring results 144 of these were non-compliant "at risk". 1 of these were put into 1b "probably at risk" 58 of these were put into the 2a "probably not at risk" category and 415 were put into the 2b "not at risk" category.

3.5 Loadings

A spreadsheet has been prepared with the annual average load (tonnes/year) for the following substances where possible:

- Organic load (as TOC, BOD, COD)
- Nitrogen
- Phosphorus
- Priority Substances (33 priority substances and 8 other pollutants prioritised at European level)
- Candidate relevant pollutants (148 pollutants prioritised at national level).

For the industries that the actual discharge information is not available the spreadsheet includes discharges estimated as 25% of maximum allowable discharge i.e. 0.25 times maximum flow times maximum allowable nutrient concentrations as carried out for the Article 5 Risk Assessments (Working Group on Characterisation and Risk Assessment, 2004). This method was used for Article 5 in order to quantify the relative significance of human activities in Ireland; the nutrient derived loading was estimated in accordance with the OSPAR (Oslo Paris Convention) procedures as described in the "Marine Direct Impacts Assessment".

The total national loadings in tonnes/year are tabulated below for organic, nutrient, priority substances and relevant pollutants.

Table 9: Organic and nutrient loadings for unsewered IPPC licensed industries nationally (tonnes/year)

Organic load	TOC	BOD	COD	Suspended Solids	Total Dissolved Solids	Chlorine	Sulphate
	763.35	6746.31	30711.13	8394.40	8.39	1077.10	5815.00
	Nitrogen	**Nitrite**	**Nitrate**	**Total Ammonia**	**Kjeldahl Nitrogen**		
Nitrogen	425.75	7.00	728.93	1447.17	7.00		
	Phosphorus	**Ortho P**	**Phosphate**				
Phosphorus	63.69	8.38	3.75				

The IPPC licenses generally contain Emission Limit Values for the organic pollutant parameters and therefore there is information available for these parameters. Large quantities of these pollutant parameters were noted to be discharged from the IPPC licensed industries nationally.

Table 10: Priority Substances loadings for unsewered IPPC licensed industries nationally (tonnes/year)

Cadmium	Lead	Mercury	Nickel	Benzene	BTEX	PAH
0.16	0.51	0.12	0.18	2.26	35.11	0.01

Dichloramethane	Naphthalene	Trichloroethylene	Tetrachloroethylene
3.03	0.09	0.01	0.01

Less information was available about the loadings of priority substances that were discharged from IPPC licenses than the organic and nutrient loadings. Cadmium and mercury are the two priority hazardous substances that are noted to be discharged to water from IPPC licensed industries. Under the proposed Priority Substances Directive these priority hazardous substances will be subject to phase-out or cessation of emissions, discharges and losses. Measures will have to be put in place to cease the discharge of these substances. This may involve changes in the manufacturing processes in the industries that are discharging these substances. There are also reduction targets under the proposed directive that will have to be met for the priority substances that are being discharged.

Table 11: Specific relevant pollutants loadings for IPPC licensed unsewered industries nationally (tonnes/year)

Zinc	Copper	Chromium	Arsenic	Phenol	Cyanide	Toluene	Xylene
8.30	0.39	0.26	0.25	0.18	3.36	5.95	2.46

These are the relevant pollutants that have EQS proposed for them as part of the initial Classification of Surface water document (Environmental Protection Agency, 2007a). More data will be required on the discharge of these substances and monitoring through the WFD surveillance monitoring will show if the discharge of these substances will effect compliance with the WFD objectives.

Table 12: Candidate relevant pollutants loadings for IPPC licensed industries nationally (tonnes/year)

Boron	Barium	Cobalt	Tin	Aluminium
4.01	0.10	0.08	7.51	5.84
Benzylchloride	**Vinyl Chloride**	**Trichloroacetic Acid**	**Ethyl Benzene**	**Chloride**
3.98	0.01	0.40	0.59	5674.67

The remaining relevant pollutants that there is data available for are as noted above. These substances should be taken into account when developing further EQSs.

The current loadings spreadsheet shows that there are still many gaps in the data that is currently available. The use of electronic Annual Environmental Reports for reporting from 2008 will assist the development of similar loadings data spreadsheets as there will be one database where the information will be available. There is a need for further monitoring of discharges to investigate the presence of priority substances across the different IPPC and Section 4 licences to take into account the proposed surface water EQSs. This is discussed further as part of an IPPC licence review in Section 5. The EPER data that was collected expresses benzene, toluene, ethylbenzene and xylene as BTEX. There was 3.5 tonnes of BTEX noted to be discharged per year from the loadings spreadsheets it would be useful however to have this broken down into the substances.

The Department of Environment, Heritage and Local Government draft guidance (Version 6) for the development of the River Basin Management Plan (Department of Environment, Heritage and Local Government, 2007) states that the local authorities/agency must establish inventories of emissions, discharges and losses of all priority substances and other significant pollutants by March 2011 for the purpose of verifying progress towards compliance with the reduction or cessation objectives. It also states that the agency may issue guidance on the data to be collected for the purpose of establishing the inventory. For the purposes of establishing these inventories the local authority/agency may direct a public authority to put in place the necessary arrangements for the collection and transmission to the local authority/agency of prescribed data on discharge authorisations in a manner to be decided by the local authority/agency. This development of inventories of discharges should build on the limited information available to date.

4.0 Informing the Design of Monitoring Programme

The monitoring results from the national screening programme were reviewed to determine which of the candidate 148 relevant pollutants were potentially occurring in significant quantities and should be monitored under the WFD surveillance monitoring programme. The rationale which identified 28 parameters was as follows:

- specific pollutants detected in "significant quantities" (criterion >¼ Target concentration) (25)
- any substances which is already regulated under S.I. No. 12 of 2001 (Dangerous Substances Directive) (3)

The 28 dangerous substances identified are on Ireland's core monitoring list and are to be monitored at every freshwater surveillance site. A further 11 substances have been put on a supplementary list; these are not going to be monitored at all sites**.** Sampling will be focused on specific target sites for example downstream of known uses or at cross border sites.

Table 13: Specific pollutants included in the WFD monitoring programme

No.	Monitoring List	Reason for inclusion	CAS Number
Core Monitoring List			
1	Antimony	Presence in significant quantities	7440-36-0
2	Arsenic	Dangerous Substances Regulations and presence in significant quantities	7440-38-2
3	Barium	Presence in significant quantities	7440-39-3
4	Boron	Presence in significant quantities	7440-42-8
5	Chromium	Dangerous Substances Regulations and presence in significant quantities	7440-47-3
6	Cobalt	Presence in significant quantities	7440-48-4
7	Copper	Dangerous Substances Regulations and presence in significant quantities	7440-50-8
8	Cyanide	Dangerous Substances Regulations	57-12-5
9	Epichlorohydrin	Presence in significant quantities	106-89-8
10	Epoxiconazole	Presence in significant quantities	135319-73-2
11	Fenitrothion	Presence in significant quantities	122-14-5
12	Fluoride	Dangerous Substances Regulations and presence in significant quantities	16984-48-8
13	Glyphosate	Presence in significant quantities	1071-83-6
14	Malathion	Presence in significant quantities	121-75-5
15-18	Maneb/zineb/thiram/mancozeb	Presence in significant quantities	n/a
19	Mecoprop	Presence in significant quantities	96-65-2
20	Molybdenum	Presence in significant quantities	7439-98-7
21	Nonylphenol ethoxylates	Presence in significant quantities	37340-60-6
22	Pirimiphos-methyl	Presence in significant quantities	29232-93-7
23	Selenium	Presence in significant quantities	7782-49-2
24	Tin	Presence in significant quantities	7440-31-5
25	Toluene	Dangerous Substances Regulations	108-88-3

No.	Monitoring List	Reason for inclusion	CAS Number
26	Vanadium	Presence in significant quantities	7440-62-2
27	Xylene-o	Dangerous Substances Regulations and presence in significant quantities	1330-20-7
	Xylene-p,m		1330-20-7
28	Zinc	Dangerous Substances Regulations and presence in significant quantities	7440-66-6
Supplementary Monitoring List			
1	2,4/2,5-dichlorophenol	Expert review	120-83-2
2	Monochlorobenzene	Expert review	108-90-7
3	Di-n-butylphthalate	Expert review	84-74-2
4	2,4-D	Expert review	94-75-7
5	Cypermethrin	Expert review	97955-44-7
6	Dimethoate	Expert review	60-51-5
7	Diazinon	Expert review	333-41-5
8	MCPA	Expert review	94-74-6
9	1,1,2,2-tetrachloroethane	Expert review	79-34-5
10	Phenol	Expert review	106-95-2
11	Linuron	Expert review	330-55-2

5.0 Framework for Prioritisation of Activities

The scope of this study involves developing inventories, risk assessments and GIS registers of dangerous substances. From this information it is possible to prioritise waterbodies of greatest risk where programme of measures addressing dangerous substances will be prioritised.

Measures from this study include the review of IPPC licences. Guidance has been developed on how the IPPC licence review might possibly be prioritised to reflect the potential new water quality standards.

5.1 Proposal for IPPC licence review

Under the Water Framework Directive (WFD) and the European Commission's Priority Substances Proposal (Com (2006)397 final); which sets out the priority substances and the priority hazardous substances; a review of the dangerous substances discharged to waters is necessary to ensure that all waters meet the WFD's objectives. For priority substances, measures shall be aimed at their progressive reduction and priority hazardous substances measures will aim at the cessation or phasing out of discharges, emissions and losses.

Ireland will set Environmental Quality Standards (EQS) for specific relevant pollutants in 2008 and will adopt the priority substances and the priority hazardous substances standards when these are agreed at European level (Appendix 1, table 17 and 18 lists the priority substances, priority hazardous substances and Ireland's Phase 1 specific relevant pollutants). A review of all licences issued under the IPPC directive is required when new EQSs are set to ensure that the receiving waters can achieve these water quality standards. On account of these imminent standards this Programme of Measures and Standards (POMS) study developed a procedure that is suggested to prioritise IPPC licences for review in relation to their discharge of dangerous substances. It was considered that the risk assessment exercise presented above in section 3 would not be used to prioritise IPPC licenses for review as all IPPC licenses will have to take into account the new proposed EQSs. The process of review will be carried out by the EPA and will start in the last quarter of 2009. The IPPC industries that are discharging directly to water will be reviewed initially. There are currently at least 170 such licences discharging to water.

The proposal set out for this review is as follows. The license review could prioritise the licences on the basis of their use or likelihood of use of priority hazardous substances. License holders could be asked to carry out initial screening monitoring of the industry's effluent, monthly for a period of six months, for an industry specific list of substances. The list of substances to be monitored should include the priority hazardous substances, priority substances and specific relevant pollutants. Industries should demonstrate that a substance is not being discharged in the effluent before the substance can be removed from the monitoring list.

There would then be four possible outcomes from the initial screening monitoring programme.

1. If the data from the industry's initial effluent monitoring confirms that the industry is not discharging priority hazardous substances or priority substances and is not discharging specific relevant pollutants in quantities that are likely to affect Environmental Quality Standard (EQS) compliance the industry may not be asked to complete a review of the IPPC licence.

2. If after the initial monitoring process there is uncertainty whether or not the levels of specific relevant pollutants discharged will affect the EQS compliance or compromise WFD good status, the industry may be requested to conduct investigative monitoring upstream and downstream of the facility as well as of the effluent for a further twelve months. If the investigative monitoring data shows that the industry is likely to affect EQS compliance or WFD good status is likely to be compromised by the industry's emissions an IPPC licence review may be carried out and the industry may be requested to conduct monthly compliance monitoring for a further twelve months. However, if the investigative monitoring data shows that the levels of specific relevant pollutants will not affect the EQS compliance or will not compromise good status under the WFD they may not have to carry out a review.

3. If the data from the industry's initial effluent monitoring confirms that the industry is discharging specific relevant pollutants in quantities likely to affect EQS compliance or good status under the WFD a review of the licence will be carried out. (Alternatively technical amendments to the licence could be made, if they would be appropriate in achieving the above objectives). The industry may also be requested to conduct monthly compliance monitoring upstream and downstream of the facility as well as of the effluent for a further twelve months. (Amendment to the monitoring schedule of the licence may also be appropriate).

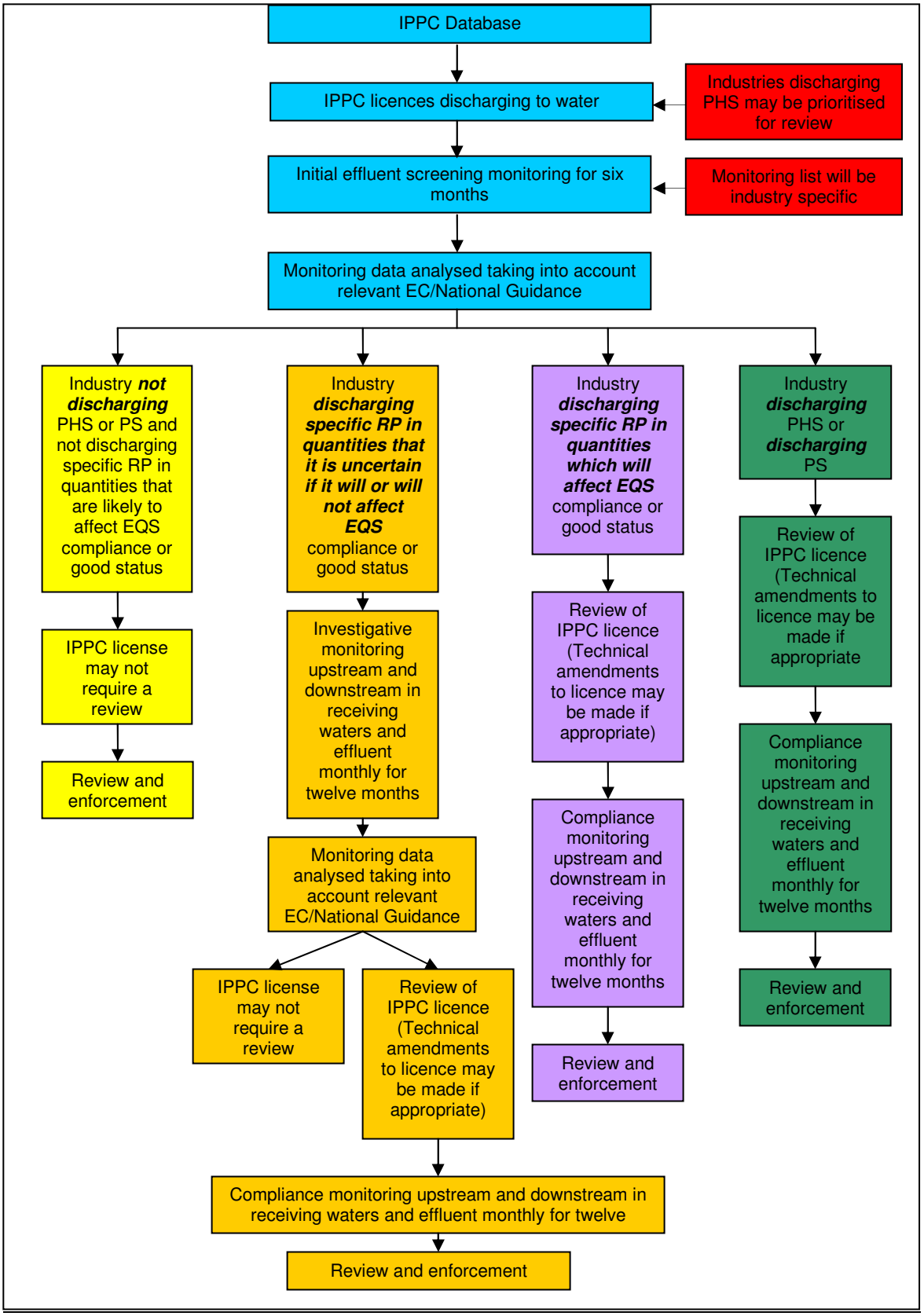
4. If the data from the industry's initial effluent monitoring shows that the industry is discharging priority hazardous substances or discharging priority substances an IPPC licence review may be carried out to achieve the WFD cessation or reduction targets respectively and to ensure the effluent does not compromise WFD good status and EQS compliance. (Alternatively technical amendments to the licence could be made, if they would be appropriate in achieving the above objectives). The industry may also be requested to conduct monthly compliance monitoring upstream and downstream of the facility as well as of the effluent for a period of twelve months. (Amendment to the monitoring schedule of the licence may also be appropriate).

Enforcement and review is necessary to ensure full compliance with the EQSs.

Compliance with the EQS will be determined on the EQSs proposed at the time and taking into account any European or national relevant guidance e.g. European guidance on mixing zones that may be developed. The diagram below sets out a possible procedure for reviewing IPPC licences.

(Note: consideration for prioritising IPPC licences based on discharging dangerous substances to protected areas in particular into waters used for drinking waters is still ongoing).

Figure 9: Proposal for IPPC license review



5.2 Section 4 and 16 licences

Similarly local authorities will be required to review potential discharge of dangerous substances licensed under Section 4 and Section 16 of the Water Pollution Acts to reflect the new water quality standards contained in proposed Surface Water Classification Regulations. Currently local authorities are applying for Waste Water Discharge Licences under the Waste Water Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007). As part of this process, where it is considered that any of the substances listed in Annex X of the Water Framework Directive (WFD) or any of the relevant pollutants listed in Annex VIII of the WFD are being discharged from the waste water works or are seen to be present in the receiving water environment downstream of a discharge from the works (as a result of any monitoring programme) the local authorities will screen the discharge for the relevant substance (Environmental Protection Agency, 2007). The first of these applications was submitted in December 2007 and licensing is now ongoing for the WWTPs nationally.

As part of the process of applying for a licence, local authorities are reviewing industrial discharge licences. This study's Section 4 licences risk assessment should be taken into account by the local authorities when reviewing industrial licences. The industries highlighted as "at risk" of discharging dangerous substances should be prioritised for review and further investigation carried out by the Local Authorities in conjunction with the licence holders. A review of all Section 16 licences should also be undertaken by all local authorities using local knowledge as there is no concise national database of these licences to enable a national risk assessment of these Section 16 licences. A concise national database of Section 16 licences should be produced.

The discharges that the local authorities licence under the Section 4 and Section 16 licences are not uniform across the local authorities. The local authorities will need to put in place a more robust management system for Section 4 and 16 licensing than is currently in place as also recommended in the Regulatory Impact Assessment (RIA) for the proposed EQSs (Environmental Resource Management, 2007). The process of what discharge should apply for a licence should be clarified so that there is a uniform system nationally.

6.0 Gaps and Recommendations

Whilst this usage study has generated substantial dangerous substances inventories and enabled development of risk assessment and loading calculations there are outstanding gaps in the information that is available on the use and discharge of dangerous substances in Ireland. Quantifying discharges of dangerous substances is not a simple task as dangerous substances use is widespread. A number of key gaps of information on dangerous substances have been highlighted through the completion of this study.

For industrial use of dangerous substances the information collected to date has not been collated electronically and was therefore not readily accessible within the EPA or to other interested bodies. The annual environmental reports will be collated electronically from 2008 along with data for the E-PRTR regulation. This will be the first step to producing comprehensive databases of discharge information. IPPC licences review will be an important step in investigating the discharges of dangerous substances nationally. Under REACH industries will be asked to register information on the chemicals they are involved in manufacturing or importing directly with the European Chemicals Agency (ECHA) in Helsinki. More information may become available through the process of complying with the REACH regulation.

One of the key constraints as set out in the terms of reference of this study was data availability and buy- in of regulatory authorities (and stakeholders). Information on agricultural landuse layers has not been made available from the Department of Agriculture, Fisheries, and Food as it is seen as confidential as farms are privately owned. More detailed information should become available from the Department of Agriculture, Fisheries and Food under the Nitrates Action Programme as stated in the regulations (S.I. No. 378 of 2006 European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2006). Article 27 states that the Minister for Agriculture, Fisheries and Food shall prepare and keep updated registers of holdings which will be made available to local authorities. This data is not yet available but will be available to local authorities in the future and it will be a useful resource for the development of concise agricultural inventories.

As part of the development of this study and the data collection process, requests for information on dangerous substances usage were sent to local authorities. The response to these requests was poor. The local authorities do not routinely collate records on their use of dangerous substances. The information available on the use of dangerous substances from these authorities needs to be improved. It was indicated in a Department of the Environment, Heritage and Local Government circular in September 2006 that further controls of some of the activities undertaken by local authorities may be likely in the future under Article 7 of the Dangerous Substances Directive (76/464/EEC). Under Article 7, Member States are required to establish pollution reduction programmes which must include prior authorisation by the competent authority in relation to all discharges to waters which are liable to contain any of the substances referred to in List II of the Annex to the Directive. Ireland was found to have failed to fulfil its obligations

in this regard in the European Court of Justice, in a judgement given by it in June 2005. Under the Dangerous Substances Directive (76/464/EEC) and in accordance with the requirements of Waste Water Discharge (Authorisation) Regulations, 2007 the EPA are currently licensing all major wastewater treatment plants (WWTP). All WWTPs greater than 500 Population Equivalent (PE) will be licensed by the EPA. This licensing will include storm water overflow and emergency water overflows. (Few if any will discharge to groundwater.) For smaller aggregations with discharges to water or groundwater regulation will be put in place by way of certificate of authorisation. As part of this process the local authorities will be required to carry out a review of all the Section 16 licensed industries and their probable discharges of dangerous substances. Information received from the application for WWTPs licences and the subsequent monitoring that will take place will go towards developing inventories of dangerous substances from WWTPs. It should be noted that the application form for the local authorities WWTPs licences has a list of substances from S.I. 12 of 2001 Water Quality (Dangerous Substances) Regulations. This list should be updated to include the WFD standards when these are written into law.

The discharges that the local authorities licence under the Section 4 and Section 16 licences are not uniform across the Local Authorities. The process of what discharge should apply for a licence should be clarified so that there is a uniform system nationally. A concise national database of Section 16 licences should be produced.

Information on the use of dangerous substances was also requested from airports and transport authorities (Iarnrod Eireann). The information provided by the airports was quite general information. There was no reply from Iarnrod Eireann. Information on the use of dangerous substances from these sites should be requested by the EPA or another relevant public enforcing body.

Domestic sources and service sector usage of dangerous substances is difficult to quantify and this remains a gap in the information available on dangerous substances discharges. There is limited information available on domestic and service sector usage from the UKWIR catchment study. There is also some information available from the Commission's source screening and measures sheets for the priority substances associated with domestic use (Directorate General for Environment, 2004a and Directorate General for Environment, 2004b). WFD monitoring has commenced and the dangerous substances monitoring may highlight domestic use substances that need further investigation. Under the development of the programme of measures and the implementation of the River Basin Management Plan information on environmentally friendly products should be provided for the public. There is possibly a need for an awareness campaign to be put in place to highlight the impacts of dangerous substances. At the South Eastern River Basin District public meetings held in November 2007 it was suggested that possible incentives or government levies should be applied to encourage the use of products that do not contain dangerous substances nationally. The ongoing WWTP licensing should also go towards providing additional information on the substances in domestic discharges.

The Western River Basin District prepared an inventory of dangerous substances usage from forestry. This inventory was prepared from data received from Coillte on their use of pesticides. Data is not available for the private forest sector. The state (i.e. Coillte) has ownership of 57% of forest cover nationally and 43% is privately owned (Irish Timber Growers Association, 2006). The continued increase in forest cover is driven by the private sector. Planting by the State has remained static since the mid 1980's whilst private forest planting has increased dramatically (Western River Basin District, 2006). The Pesticide Control Service authorise the use of pesticides for use in forestry but there is no data collection on the use of pesticides in the private sector. It may be possible to carry out surveys similar to those for agriculture to gather data on pesticide usage for privately owned forestry. An electronic database of use would be a very useful tool for further study.

The WFD dangerous substances monitoring programme began in July 2007. The parameters include glyphosate, cypermethrin and atrazine among other pesticides. In the WFD Operational Network there will be sixteen forest impact study sites, one dangerous substances forestry site and ten forestry multiple pressures sites where monitoring will take place in the first WFD cycle. This information from the WFD monitoring programme will give a more comprehensive indication of the pesticides released from forestry. The Western River Basin District usage information should be taken into account when examining the WFD monitoring results.

Pesticide usage in Ireland is regulated by the Pesticide Control Service. It was noted when developing the agricultural and forestry inventories that the use of pesticides for the treatment of insects changes regularly as the insecticide becomes ineffective after a certain period of use. The development of EQSs for pesticides should take this into account. An electronic database of pesticide use in Ireland would be a useful source of information.

The Pesticide Control Service will continue to carry out further studies into the use of pesticides (depending on resources) that will be useful sources of information for further investigation. These include surveys into the use of pesticides in other crops, amenity areas such as golf-courses, forestry and investigations into the use of biocides.

It should also be noted that usage of aquaculture medicines, for example those that are used for the treatment of lice in finfish farms, can change regularly as the treatment may become less effective after a certain period of use. Regular updates of information on treatment use in aquaculture are warranted.

As part of the dangerous substances screening study and the South Western River Basin District Municipal and Industrial Regulations POMS study investigation into the dangerous substances in leachate and the

treatment of leachate in wastewater treatment plant (WWTP) was carried out. The data on leachate discharges and its treatment in WWTP from these studies are limited however. The screening study only analysed one landfill's leachate, this showed that 32 priority substances and 15 specific relevant pollutants were detected in one or more samples (Environmental Resource Management, 2007). This specific site may not be representative of all landfills currently operating in Ireland. Some facilities currently treat leachate onsite while others transport it to a municipal WWTP, where it is added to the treatment stream. The South Western River Basin District analysis investigated the effect of leachate on three WWTPs discharge but the analysis was not conclusive. Landfill leachate warrants further study as the sources are mixed and varied. It is also recommended that further effluent characterisation be carried out to establish the dangerous substances found in effluents and how they are treated in WWTPs.

7.0 Conclusions

The dangerous substances usage literature review concluded that the majority of the studies available on the use of dangerous substances are UK based. The industrial sectors of importance and domestic use of dangerous substances are similar in Ireland and the UK. Domestic sources and service sector usage data is difficult to quantify and there is only a small amount of general information available on domestic usage.

The ongoing licensing of wastewater treatment plant discharges and storm overflows will set mandatory emission limits and specify monitoring requirements to achieve new quality standards in receiving waters. Other local authority discharges containing dangerous substances, which may require licensing, are being studied. Information will be collated under these new regulations that will go towards quantifying the domestic and service sector use of dangerous substances.

In June 2007 a European regulatory framework for the Registration, Evaluation and Authorisation of Chemicals (REACH) set up a registration system for chemical usage. Chemicals identified under REACH will be assessed for the risks they pose to human health and the environment. Under the REACH regulation inventories of chemicals will be developed. The information from the regulation will also go towards quantifying the use of dangerous substances from the different sectors. The information from this dangerous substances study will be used in the interim, before the information is available from REACH for the development of the river basin management plans.

The screening study that was carried out by the South Eastern River Basin District to investigate the dangerous substances in Irish waterbodies is complete and is due to be released for public information. This is an important source of data on dangerous substances but it is limited to a small number of sites that were selected as a worst case scenario. The surveillance monitoring under the WFD directive has commenced and monitoring of dangerous substances is more widespread and extensive. The operational network should take into account the dangerous substances risk assessments produced as part of this dangerous substances study.

The inventories produced as part of this study are a good source of information on the use and discharge of dangerous substances by the agricultural, industrial, aquaculture and forestry sectors. The industrial inventory still lacks actual discharge information for the majority of industries. This needs to be addressed. The collation of information under the E-PRTR regulation and the provision of electronic AERs will go towards eliminating this gap in information. The list of E-PRTR substances are listed and compared with the priority substances and the relevant pollutants in Table 35, Appendix 1. All the priority substances are included on the E-PRTR list of substances. A number of the specific relevant pollutants are not listed as E-PRTR substances; these are the pesticides generally as listed below:

- Cypermethrin
- 2,4-D
- Diazinon
- Dimethoate
- Glyphosate
- Linuron
- Mancozeb
- Mecoprop
- Monchlorobenzene

These substances are mostly pesticides and are therefore associated with other sources rather that industrial uses and are therefore not included in the E-PRTR list of substances.

The proposed review of IPPC licences will also go towards providing information on the discharges of dangerous substances. It is important that this review takes place to ensure no deterioration of status and to comply with the EQSs proposed under the WFD. The Section 4 and 16 licensing system will also need to be examined and aligned nationally for the objectives of the WFD to be achieved.

Under the WFD and the European Commission's Priority Substances Proposal (Com (2006)397 final); which sets out the priority substances and the priority hazardous substances; the priority substances measures shall be aimed at their progressive reduction and the priority hazardous substances measures will aim at the cessation or phasing out of discharges, emissions and losses. Taking this into account it is important at this stage to highlight the priority hazardous substances noted to be in discharges or in use and the priority substances that were noted to be found in discharges. Additionally it is important to note where the specific relevant pollutants are in use and which of the candidate relevant pollutants are in common use and may need to be included in phase two of the setting of EQSs. The original candidate relevant pollutant list will be kept under review and will be re-examined for the EQS development and/or further monitoring. Phase 2 standards will be progressed during the river basin planning cycles. The list of candidate relevant pollutants may also be reviewed as further information becomes available.

Table 14: Priority substances in use in agriculture, industry and forestry.

Priority Substances	Industry	Agriculture	Forestry
1,2-dichloroethane	x		
Atrazine		x	x
Benzene	x		
Cadmium and compounds*	x		
Chlorpyrifos		x	
Dichloromethane (DCM)	x		
Di-(2-ethyl hexyl) phthalate	x		
Isoproturon		x	
Lead and compounds (as Pb)	x		
Mercury and compounds (as Hg*	x		
Naphthalene	x		
Nickel and compounds (as Ni)	x		
Nonyphenols	x		
Simazine		x	
Tetrachloroethylene (PER)	x		
Trichloroethylene	x		
Trichloromethane	x		
Trifluralin		x	

***** Priority hazardous substances: measures will aim at the cessation or phasing out of discharges, emissions and losses.

Table 15: Specific relevant pollutants in use in agriculture, industry and forestry

Specific Relevant Pollutants	Industry	Agriculture	Forestry
2,4-D		x	
Arsenic and compounds	x		
Chromium and compounds	x		
Copper and compounds	x		
Cyanide	x		
Cypermethrin		x	x
Dimethoate		x	
Fluoride	x		
Glyphosate		x	
Linuron		x	
Mancozeb		x	
Mecoprop		x	
Phenols (as total C)	x		
Toluene	x		
Xylenes	x		
Zinc	x		

Table 15 above shows the use of the specific relevant pollutants in Ireland. The specific relevant pollutants have been proposed as EQSs as part of the surface water classification process (Environmental Protection Agency, 2007a).

The candidate relevant pollutants that were noted to be discharged from the questionnaire results, the EPER, and the AER database were as listed in table 16.

Table 16: Candidate relevant pollutants usage

Substance	CAS Number	EQS proposed	WFD Monitoring	Agriculture	Forestry	Industry	Aquaculture
Antimony	7440-36-0		x			x	
Arsenic	7440-38-2	x	x			x	
Barium	7440-39-3		x			x	
Benzylchloride	100-44-7					x	
Beryllium	7440-41-7					x	
Boron	7440-42-8		x			x	
Chloride	16887-00-6					x	
Chromium	7440-47-3	x	x			x	
Cobalt	7440-48-4		x			x	
Copper	7440-50-8	x	x			x	
Cyanide	140-33-9	x	x			x	
Ethylene Benzene	100-41-4					x	
Fluorides	16984-48-8	x	x			x	
PCDD	n/a					x	
PCDF	n/a					x	
Phenols	n/a	x	x			x	
Selenium	7782-49-2		x			x	
Silver	7440-22-4					x	
Tellurium	1349-80-9					x	
Titanium	7440-32-6					x	
Tin	7440-31-5		x			x	
Toluene	108-88-3	x	x			x	
Vinyl Chloride	75-01-4					x	
Xylenes	1330-20-7	x	x			x	
Zinc	7440-66-6	x	x			x	
2,4-D		x	x	x			
Azoxystrobin	131860-33-8			x			
Bromoxynil	1689-84-5			x			
Carbendazim	1060521-7			x			
Carbofuran	1563-66-2			x			
Chlormequat	7003-89-6			x			
Cypermethrin	52315-07-8/66841-24-5	x	x	x	x		x
Deltamethrin	52918-63-5			x			x
Dichlorprop	120-36-5			x			
Dimethoate	60-51-5	x	x	x			
Epoxiconazole	13519-73-2		x	x			

Substance	CAS Number	EQS proposed	WFD Monitoring	Agriculture	Forestry	Industry	Aquaculture
Ethofumesate	26225-79-6			x			
Fenpropimorph	67306-03-0/67564-91-4			x			
Flusilazole	85509-19-9			x			
Glyphosate	1071-83-6	x	x	x	x		
Ioxynil	1689-83-6			x			
Kresoxim methyl	143390-89-0			x			
Linuron	330-55-2	x	x	x			
Mancozeb	8018-01-7	x	x	x			
Maneb	124727-38-2		x	x			
MCPA	94-74-6		x	x			
Mecoprop	93-65-2,7058-19-0	x	x	x			
Metamitron	41394-05-2			x			
Methiocarb	2032-65-7			x			
Oxydemeton-methyl	301-12-2			x			
Paraquat	1910-42-5 for dichloride salt / 4685-14-7 for dictation			x			
Pendimethalin	40487-42-1			x			
Pirimicarb	23103-98-2			x			
Prochloraz	67747-09-5			x			
Propachlor	1918-16-7			x			
Propyzamide	23950-58-5			x			
Thiabendazole	148-79-8			x			
Thiram	137-26-8		x	x			
Tribenuron (-methyl)	101200-48-0			x			
Emamectin benzoate	137512-74-4						x

The substances in this list that do not have standards proposed for them should possibly be prioritised when looking at Phase 2 development of specific relevant pollutants standards.

More detailed information on the list of candidate substances and their use in industries as noted in the questionnaire results and their likely presence in discharges according to the DEFRA spreadsheets is available in Table 34, Appendix 1.

From this information it can be noted that the use and discharges of dangerous substances is widespread.

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Appendix 1

Table 17: Proposed Priority Substances (*Priority Hazardous Substances)

Number	Substance
1	Alachlor
2	Anthracene*
3	Atrazine
4	Benzene
5	Pentabromodiphenlyether*
6	Cadmium* and its compounds
7	C10-13-Chloralkanes*
8	Chlorfenvinphos
9	Chlorpyrifos
10	1,2-Dichloroethane
11	Dichloromethane
12	Di (2-ethylhexyl) phthalate (DEHP)
13	Diuron
14	Endosulfan*
15	Fluoranthene
16	Hexachlorobenzene*
17	Hexachlorobutadiene*
18	Hexachlorocylohexane* (Lindane)
19	Isoproturon
20	Lead and its compounds
21	Mercury* and its compounds
22	Naphthalene
23	Nickel and its compounds
24	Nonylphenols*
25	Octylphenols
26	Pentachloro-benzene*
27	Pentachlorophenol
28	Polyaromatic Hydrocarbon* (PAH)
	(benzo-a-pyrene)
	(benzo-b-fluoranthene)
	(benzo-k-fluoranthene)
	(benzo-k-fluoranthene)
	(benzo-g,h,i-perylene)
	(indeno(1,2,3-cd)pyrene)
29	Simazine
30	Tributyltin*
31	Trichlorobenzene (all isomers)
32	Trichloromethane
33	Trifluarin
34	DDT total*
35	Aldrin*

Table 17: Proposed Priority Substances (*Priority Hazardous Substances) continued

Number	Substance
36	Endrin*
37	Dieldrin*
38	Isodrin*
39	Carbontetrachloride*
40	Tetrachloroethylene*
41	Trichloroethylene*

Table 18: Proposed Specific Relevant Pollutants

Specific Relevant Pollutants	
1	Arsenic
2	Chromium (III Chromium (VI)
3	Cypermethrin
4	Copper
5	Cyanide
6	2,4 D
7	Diazinon
8	Dimethoate
9	Fluoride
10	Glyphosate
11	Linuron
12	Mancozeb
13	Mecoprop
14	Monochlorobenzene
15	Phenol
16	Toluene
17	Xylenes (Total)
18	Zinc

Table 19: List of IPPC Licence Holders to whom the WFD Dangerous Substances Questionnaire was sent:

Licence Number	Licence Name	Questionnaire Returned
P0004-02	Smithkline Beecham (Cork) Limited	x
P0005-01	Schering-Plough (Brinny) Company	x
P0006-03	Novartis Ringaskiddy Limited	
P0007-03	Astellas Ireland Co., Limited	x
P0008-01	Leo Laboratories Limited	x
P0009-03	Eli Lilly S.A. - Irish Branch	x
P0010-03	Pfizer Ireland Pharmaceuticals Limited	x
P0011-02	Merck Sharp & Dohme (Ireland) Limited	x
P0012-04	Roche Ireland Limited	x
P0013-04	Pfizer Ireland Pharmaceuticals	x
P0014-03	Swords Laboratories	x
P0015-03	Schering-Plough (Ireland) Company	x
P0016-02	Janssen Pharmaceutical Limited	x
P0017-01	Cara Partners	x
P0018-01	Klinge Pharma & Co	x
P0019-02	Pfizer Ireland Pharmaceuticals	x
P0020-02	Schwarz Pharma Limited	x
P0022-02	Finsa Forest Products Limited	x
P0023-01	Howmedica International Inc	x
P0034-02	Dynea Ireland Limited	x
P0035-02	Aughinish Alumina Limited	x
P0041-02	Dublin Products Limited	
P0050-02	Mallinckrodt Medical Imaging – Ireland	x
P0051-01	BOC Gases Ireland Ltd.	
P0052-01	Cognis Ireland Limited	x
P0055-01	Irish Industrial Explosives Ltd	
P0057-01	Kingspan Insulation Ltd	x
P0058-01	Kayfoam Woolfson	x
P0059-01	Fronville Ltd.	x
P0060-01	Arch Chemicals B.V	x
P0061-03	Organic Lens Manufacturing	x
P0062-01	Carol Zeiss Vision Ireland Limited	x
P0064-01	DIS Enbi seals Ireland Ltd.	x
P0065-01	Kingspan Building Products Ltd.	
P0070-01	Irish Oxygen Co. Limited	x

Table 19: List of IPPC Licence Holders to whom the WFD Dangerous Substances Questionnaire was sent continued

Licence Number	Licence Name	Questionnaire Returned
P0076-01	Chemifloc Ltd.	x
P0079-03	Henkel (Ireland) Limited	
P0080-01	Colfix (Dublin) Ltd	x
P0082-01	Micro Bio (Ireland) Ltd	x
P0085-01	Novartis Animal Health Ireland Limited	x
P0087-01	Schloetter (Ireland) Limited	x
P0089-02	SAFC Arklow Limited	x
P0090-01	Fort Dodge Laboratories Ireland Limited	x
P0091-02	Wexport Limited	x
P0096-02	Saint-Gobain Performance Plastics Ireland	x
P0099-01	IVAX Pharmaceuticals Ireland	
P0100-02	Elan Corporation Plc	x
P0101-01	Norbrook Manufacturing Ltd	x
P0103-01	Pfizer Cork Limited	x
P0110-01	Arran Chemical Company Limited	x
P0115-04	Inamed Corporation Irelandx	x
P0117-01	Ipsen Manufacturing Ltd	
P0119-01	Alcan Packaging Dublin Limited	x
P0120-03	Lithographic Web Press Limited	
P0125-02	Helsinn Chemicals Ireland Limited	
P0126-01	Allergan Pharmaceuticals (Ireland) Ltd	x
P0128-01	Servier International B.V	x
P0134-02	Cambrex Profarmaco Cork Ltd	x
P0136-02	Pfizer Ireland Pharmaceuticals	x
P0141-02	Info-Lab Limited & Elfotec Limited	x
P0146-01	Liebherr Container Cranes Limited	x
P0152-01	Boran Plastic Packaging Limited	
P0153-05	Wyeth Medica Ireland	x
P0157-02	Waterford Crystal Limited	x
P0163-01	Moy Isover Ltd.	x
P0180-02	Glanbia Fresh Pork Limited	
P0190-01	AIBP T/A AIBP Clones	x
P0195-02	Hewlett Packard (Manufacturing) Ltd.	x
P0198-01	Woodland Products Ltd.	

Table 19: List of IPPC Licence Holders to whom the WFD Dangerous Substances Questionnaire was sent continued

Licence Number	Licence Name	Questionnaire Returned
P0207-03	Intel Ireland Limited	x
P0200-01	Sherry Brothers Limited	
P0209-01	Valspar Industries (Ireland) Limited	
P0218-01	Dulux Paints Ireland Ltd.	
P0236-01	Wellman International Limited	x
P0244-01	FSW Coatings Limited	x
P0266-01	Conoco Phillips Whitegate Refinery Limited	x
P0275-01	Lufthansa Technik Airmotive Ireland Limited	x
P0284-02	Galco Steel Limited	
P0288-02	Molex Ireland Limited	x
P0294-01	Grant Engineering Limited	
P0301-01	Diageo Ireland	x
P0313-01	NN Euroball Ireland Limited	
P0314-01	Radley Engineering Limited	x
P0322-01	Laois Sawmills Limited	
P0324-01	Hygeia Chemicals Limited	
P0326-01	Protim Abrasives Limited	x
P0338-01	Palfab Limited	
P0343-01	Brooks Haughton Limited	
P0350-01	Waterford Joinery Limited	
P0357-01	Cross Vetpharm Group Limited	
P0366-02	Alert Packaging Limited	
P0376-01	Premier Periclase Limited	x
P0378-01	Quinn Cement Limited	x
P0386-01	Kerry Ingredients (Ireland) Ltd	x
P0395-02	Wyeth Nutritionals Ireland	x
P0401-01	Metal Processors Limited	x
P0402-02	P Carney Ltd	
P0404-01	Dairygold Co-operative Society Limited	x
P0416-01	United Fish Industries Limited	
P0422-02	Silver Hill Foods	
P0442-01	Irish Distillers Limited	x
P0443-01	Bulmers Limited	

Table 19: List of IPPC Licence Holders to whom the WFD Dangerous Substances Questionnaire was sent continued

Licence Number	Licence Name	Questionnaire Returned
P0445-1	Heineken Ireland Limited	
P0462-01	Johnson Matthey Pharmaceutical Materials	x
P0472-01	Atlas Oil Laboratories Limited	x
P0474-01	Kelly Timber Frame Limited	
P0476-01	Recordati Ireland Limited	x
P0477-01	Acorn Environmental Limited	x
P0479-01	Cavanagh Foundry Limited	
P0482-02	Edenderry Power Limited	
P0483-03	Huntstown Power Company Limited	x
P0508-03	Xerox	x
P0509-01	Amann Industries Corporation	
P0510-01	Waterford Carpets Limited	x
P0516-01	Tara Mines Limited	x
P0517-01	Galmoy Mines Limited	x
P0518-01	SIAC Butlers Steel Limited	
P0519-02	Gypsum Industries Limited	
P0521-01	Roadstone Provinces Limited	
P0522-01	Barclay Chemicals Manufacturing Limited	x
P0527-01	Flemings' Fireclays Manufacturing Limited	
P0530-01	Ormonde Brick Limited	x
P0531-01	Dineen Refractories Limited	
P0533-01	Element Six	x
P0552-01	Swords Laboratories	
P0571-01	Millipore Ireland B.V.	x
P0578-02	Electricity Supply Board (Marina)	
P0583-01	Xtratherm Limited	x
P0615-01	True Temper Limited	
P0624-01	Jedcoe Manufacturing Teo	
P0636-01	Baxter Healthcare SA	x
P0638-01	GeneMedix plc	
P0641-01	Irish Rubber Components Limited	
P0643-02	Abbott Ireland	
P0645-01	ALZA Ireland Limited	x
P0646-01	Fort Wayne Metals Ireland Limited	x

Table 19: List of IPPC Licence Holders to whom the WFD Dangerous Substances Questionnaire was sent continued

Licence Number	Licence Name	Questionnaire Returned
P0648-01	Becton Dickinson Insulin Syringe Limited	x
P0650-02	Shannonside Galvanising	
P0652-01	Wyeth Medica Ireland	x
P0666-01	Eurothane Holdings Limited	
P0687-01	Abbott Ireland	x
P0693-01	Takeda Pharma Ireland Limited	x
P0698-01	Honeywell International Technologies Ltd	x
P0725-01	Boston Scientific Ireland Limited	x
P0739-01	Quinn Therm Limited	x

Table 20: Percentage active ingredients and quantities of medicines used in finfish aquaculture in Ireland 2004 – 2006 (AR 16 – exceptional temporary license issued by Dept. of Agriculture, cascade – refers to process veterinarians may use under the Animal Remedies Regulations 2005 where there is no authorised animal remedy, MA – marketing authorisation, POM – prescription only medicine, POM (E) – prescription only exempt medicine).

Medicine	Percentage Active Ingredient	Quantity '04 – '06 (litres or kg)	Quantity active '04 – '06 (l or kg)	Authorisation status*
Alphamax	1	341	3.41	AR16
Betamox LA	15	2.4	0.36	Cascade(full MA for terrestrial animals)
Ektobann	100	177	177	AR16
Excis	1	415.2	4.15	Full MA for salmon – POM (E)
Florocol	50	45	22.5	AR16 & cascade (full MA in UK)
Maracycline	100	2,465	2,465	Full MA for salmon – POM
MS 222	100	159	159	MA pending
Pyceze	50	69	34.5	Cascade (full MA in UK)
Slice	0.2	11,865	23.7	Full MA for salmon – POM
Sulfatrim	50	98	49	License expired and medicine no longer available

The status of all medicines is subject to change but the status of listed medicines at the time of writing is given.

Table 21: Quantities (litres or kilograms) of medicines (and active ingredients) used in finfish aquaculture in Ireland 2004 – 2006.

	Quantity of medicine			Quantity of Active Ingredient		
Medicine	***2004***	***2005***	***2006***	***2004***	***2005***	***2006***
Alphamax	0	14.5	326	0	0.15	3.26
Betamox LA	0	2.4	0	0	0.36	0
Ektobann	0	0	177	0	0	177
Excis	182.8	228.8	3.6	1.83	2.29	0.04
Florocol	15	17.5	12.4	7.5	8.75	6.2
Maracycline	251.5	949	1264.5	251.5	949	1264.5
MS 222	56.7	66.9	35.2	56.7	66.9	35.2
Pyceze	16	28	25	8	14	12.5
Slice	4,169	4,500	3,193	8.34	9	6.39
Sulfatrim	67	31	0	33.5	15.5	0

Table 22: Quantities of medicines used (and active ingredients) in finfish aquaculture (freshwater and/or marine farms) in Ireland in the three years 2004 to 2006 (in litres or kilograms).

Medicine	Quantity used in freshwater (FW)	Quantity of active in FW	Quantity used in marine (SW)	Quantity of active in SW
Alphamax	0	0	341	3.41
Betamox LA	2.4	0.36	0	0
Ektobann	0	0	177	177
Excis	0	0	415.2	415.2
Florocol	8	4	37	18.5
Maracycline	105	105	2360	2360
MS 222	132	132	27	27
Pyceze	67	33.5	2	1
Slice	22.5	0.05	11842.5	23.7
Sulfatrim	18	9	80	40

Table 23: Pesticide Usage in Coillte Districts (kg a.i.)[11]

Coillte Districts	Product	Kg Active Ingredient Used per year			
		2002	2003	2004	2005
District E1	Agral				
	Alph- cypermethrin			11.9	48.1
	Arsenal/Imazapyr				
	Asulox(Asulam)	12		8	
	Atrazine				
	Gardoprim/Terbuthylazine	1.3			
	Glymark				
	Glyphosate	273.9	262.4	126.4	200.9
	Kerb Flo			10	
	No-Mix Systemic	0.9			
	Permasect	137.2	173		
	Triclopyr(Garlon)	45.1	49.6	29.5	48.7
	Total kg a.I. used	**470.4**	**484.9**	**185.8**	**297.7**
	Total Area Treated (ha)	3170	3197	2961	2592
	Chemical Usage (kgs a.i./ha)	**0.1484**	**0.1517**	**0.0628**	**0.1148**
District E2	Agral	15	15	6.8	3.8
	Alph- cypermethrin			20.8	48.2
	Arsenal/Imazapyr				
	Asulox(Asulam)	50.4	9.2	41.6	22
	Atrazine				
	Gardoprim/Terbuthylazine	148.8	2		
	Glymark				
	Glyphosate	288.2	268.1	214.9	162.4
	Kerb Flo				
	No-Mix Systemic	7.9			
	Permasect	284.4	311.7		
	Triclopyr(Garlon)	166.9	189.1	174.5	141.4
	Total Kgs a.i. Used	**946.6**	**780.1**	**458.6**	**377.7**
	Total Area Treated (ha)	3589	3422	3199	2763
	Chemical Usage (kgs a.i./ha)	**0.2638**	**0.228**	**0.1434**	**0.1367**

[11] Product names are used in this data rather than actual pesticides

Table 23: Pesticide Usage in Coillte Districts (kg a.i.) continued][12]

District E3	Agral				
	Alph- cypermethrin			59	72.6
	Cypermethrin				8
	Arsenal/Imazapyr	26.8	34.3	37.5	30.6
	Asulox(Asulam)	16	9.6	2	
	Atrazine	331.8	361	126	95
	Gardoprim/Terbuthylazine	31.3	12.5		
	Glymark				
	Glyphosate	96.2	118	22	25.4
	Kerb Flo				
	No-Mix Systemic				1
	Permasect	211.9	305.8		
	Triclopyr(Garlon)	54.9	71.7	23	25.3
	Total Kgs a.i. Used	**768.9**	**912.8**	**269.5**	**257.9**
	Total Area Treated (ha)	2183	2293	2602	2852
	Chemical Usage (kgs a.i./ha)	**0.3522**	**0.3981**	**0.1036**	**0.0904**
District N1	Agral				
	Alph- cypermethrin			118.4	164
	Cypermethrin				128.8
	Arsenal/Imazapyr		5		
	Asulox(Asulam)	4			
	Atrazine	15	25.7	122	277
	Gardoprim/Terbuthylazine	27.5			
	Glymark				
	Glyphosate	104.5		9	131
	Kerb Flo				
	Marshal suSCon granules			1.8	62.5
	No-Mix Systemic	1.4	3.4		7.7
	Permasect	554.7	393.3		
	Simazine		2		
	Triclopyr(Garlon)	7.6	1.2		
	Total Kgs a.i. Used	**714.7**	**430.6**	**251.3**	**771**
	Total Area Treated (ha)	3523	4142	4379	4220
	Chemical Usage (kgs a.i./ha)	**0.2029**	**0.104**	**0.0574**	**0.1827**

[12] Product names are used in this data rather than actual pesticides.

Table 23: Pesticide Usage in Coillte Districts (kg a.i.) continued[13]

District N2	Agral				
	Alph- cypermethrin			58.6	83.2
	Cypermethrin				6.8
	Arsenal/Imazapyr				
	Asulox(Asulam)				
	Atrazine				
	Gardoprim/Terbuthylazine				
	Glymark				
	Glyphosate		145.9	68.8	61.2
	Kerb Flo				
	Marshal suSCon granules				
	No-Mix Systemic				
	Permasect	63.6	77.1		
	Simazine				
	Triclopyr(Garlon)		6.6		2.4
	Total Kgs a.i. Used	**63.6**	**229.6**	**127.4**	**153.7**
	Total Area Treated (ha)	2737	2805	2697	2804
	Chemical Usage (kgs a.i./ha)	**0.0232**	**0.0818**	**0.0472**	**0.0548**
District N3	Agral				
	Alph- cypermethrin			45.5	23.4
	Cypermethrin				
	Arsenal/Imazapyr	22.5	34.8		
	Asulox(Asulam)	2		8	
	Atrazine	41	92	59	54.5
	Gardoprim/Terbuthylazine	2.5			
	Glymark				
	Glyphosate	172.2	130.4	63.4	96.8
	Kerb Flo				
	Marshal suSCon granules				
	No-Mix Systemic	2.9			
	Permasect	292.5	278		
	Simazine				
	Triclopyr(Garlon)	11.2	21.9	6.1	16.6
	Total Kgs a.i. Used	**546.8**	**557**	**182.1**	**191.3**
	Total Area Treated (ha)	2708	2633	3099	2527
	Chemical Usage (kgs a.i./ha)	**0.2019**	**0.2116**	**0.0587**	**0.0757**

[13] Product names are used in this data rather than actual pesticides.

Table 23: Pesticide Usage in Coillte Districts (kg a.i.) continued[14]

District S1	Agral				
	Alph- cypermethrin			72.7	137.2
	Cypermethrin				
	Arsenal/Imazapyr	0.8	0.8		
	Asulox(Asulam)	92.4	27.6	57.6	18
	Atrazine			5	
	Gardoprim/Terbuthylazine	41	41		
	Glymark				
	Glyphosate	265.1	253.2	173.9	227.9
	Kerb Flo				
	Marshal suSCon granules				
	No-Mix Systemic	11.3	15.7	61.8	28.2
	Permasect	377.6	481		
	Simazine				
	Triclopyr(Garlon)	55.9	61	81.7	8
	Total Kgs a.i. Used	**844.2**	**880.3**	**452.8**	**419.3**
	Total Area Treated (ha)	5127	5102	4293	4058
	Chemical Usage (kgs a.i./ha)	**0.1647**	**0.1725**	**0.1055**	**0.1033**
District S2	Agral			6	
	Alph- cypermethrin			29.4	84.9
	Cypermethrin				
	Arsenal/Imazapyr				
	Asulox(Asulam)	2			
	Atrazine				
	Gardoprim/Terbuthylazine	74.5	18.6	6.3	
	Glymark				
	Glyphosate	91.4	92.1	67.8	117.4
	Kerb Flo			6.1	
	Marshal suSCon granules				
	No-Mix Systemic	73.3	306.3	94.3	237.3
	Permasect	132.1	265.9		
	Simazine				
	Triclopyr(Garlon)	18.8	32.9	44.2	44.1
	Total Kgs a.i. Used	**392.1**	**715.9**	**254**	**483.7**
	Total Area Treated (ha)	3188	3238	3558	3606
	Chemical Usage (kgs a.i./ha)	**0.123**	**0.2211**	**0.0714**	**0.1341**

[14] Product names are used in this data rather than actual pesticides.

Table 23: Pesticide Usage in Coillte Districts (kg a.i.) continued[15]

District S3	Agral				
	Alph- cypermethrin			71.9	142
	Cypermethrin				2.4
	Arsenal/Imazapyr				
	Asulox(Asulam)		16	16	
	Atrazine			21.2	
	Gardoprim/Terbuthylazine	102	34.1	10.5	
	Glymark				
	Glyphosate	68.9	86.6	103.3	20.7
	Kerb Flo			4.9	
	Marshal suSCon granules				14.5
	No-Mix Systemic	1.3			0.4
	Permasect	482.1	717.5		
	Simazine				
	Triclopyr(Garlon)	29	57.7	36.7	18.4
	Total Kgs a.i. Used	**683.4**	**911.9**	**264.5**	**198.3**
	Total Area Treated (ha)	4776	4837	4389	4321
	Chemical Usage (kgs a.i./ha)	**0.1431**	**0.1885**	**0.0603**	**0.0459**
District S4	Agral				
	Alph- cypermethrin			39.7	87.5
	Cypermethrin				2.1
	Arsenal/Imazapyr				
	Asulox(Asulam)	8			
	Atrazine				4.2
	Gardoprim/Terbuthylazine	56.5	26.5		
	Glymark				
	Glyphosate	4	10.5	12.1	27
	Kerb Flo				
	Marshal suSCon granules				5.3
	No-Mix Systemic				
	Permasect	164.3	304.2		
	Simazine				
	Triclopyr(Garlon)	0.5	3.4		4
	Total Kgs a.i. Used	**233.2**	**344.6**	**51.8**	**130**
	Total Area Treated (ha)	1512	1612	1748	1754
	Chemical Usage (kgs a.i./ha)	**0.1542**	**0.2138**	**0.0296**	**0.0741**

[15] Product names are used in this data rather than actual pesticides.

Table 23: Pesticide Usage in Coillte Districts (kg a.i.) continued[16]

District W1	Agral				
	Alph- cypermethrin			41.3	33.6
	Cypermethrin				2
	Arsenal/Imazapyr				
	Asulox(Asulam)				
	Atrazine		7.5		
	Gardoprim/Terbuthylazine	148.5	68.5	5	
	Glymark				
	Glyphosate	13.9	45.5	61.3	38.7
	Kerb Flo				2.5
	Marshal suSCon granules				
	No-Mix Systemic				
	Permasect	253.1	281.1	5.8	
	Simazine				
	Triclopyr(Garlon)	7.1	13.4	10.7	10.8
	Total Kgs a.i. Used	**422.6**	**416.1**	**124**	**87.7**
	Total Area Treated (ha)	3839	3449	2898	2450
	Chemical Usage (kgs a.i./ha)	**0.1101**	**0.1206**	**0.0428**	**0.0358**
District W2	Agral				
	Alph- cypermethrin			35.9	27.3
	Cypermethrin				
	Arsenal/Imazapyr	2			
	Asulox(Asulam)				
	Atrazine	9			
	Gardoprim/Terbuthylazine		3		
	Glymark				
	Glyphosate	235.4	108.4	83	38.6
	Goltix			14	
	Kerb Flo				
	Marshal suSCon granules			19	
	No-Mix Systemic	1.8			
	Permasect	132.2	208.9		
	Simazine				
	Triclopyr(Garlon)	21.9	2.4	6.5	8.8
	Total Kgs a.i. Used	**402.3**	**322.7**	**158.5**	**74.7**
	Total Area Treated (ha)	1703	1842	1862	1857
	Chemical Usage (kgs a.i./ha)	**0.2362**	**0.1752**	**0.0851**	**0.0402**

[16] Product names are used in this data rather than actual pesticides.

Table 23: Pesticide Usage in Coillte Districts (kg a.i.) continued

District W3	Agral				
	Alph- cypermethrin			77.2	77.8
	Cypermethrin				
	Arsenal/Imazapyr				
	Asulox(Asulam)	20.8			
	Atrazine				
	Gardoprim/Terbuthylazine		5		
	Glymark				
	Glyphosate	12.6	52.6	8.9	29.3
	Goltix				
	Kerb Flo				
	Marshal suSCon granules				
	No-Mix Systemic	12.2	13.6		
	Permasect	459.4	377.9		
	Simazine				
	Triclopyr(Garlon)	43.2		0.4	0.2
	Total Kgs a.i. Used	**548.3**	**449.1**	**86.5**	**107.3**
	Total Area Treated (ha)	3484	3312	3149	3073
	Chemical Usage (kgs a.i./ha)	**0.1574**	**0.1356**	**0.0275**	**0.0349**

Table 24: Grassland and fodder crops areas and quantities of active substances

	Areas (spray hectares) treated with each active substance or active substance combination in overall treatments							**Quantities** (kilograms) of each active substance or active substance combination applied in overall treatments						
	Agriculture- Crop							**Crop**						
Active substance/combination	Grass	Maize	Fodder beet	Arable silage	Swedes/ Turnips	Kale/ Rape	**Total**	Grass	Maize	Fodder beet	Arable silage	Swedes/ Turnips	Kale/ Rape	Total
Herbicides														
2,4-D	9,528						9,528	16,998						16,998
2,4-D, dicamba, triclopyr	3,388						3,388	4,774						4,774
2,4-DB, benazolin (-ethyl), MCPA	5,914						5,914	11,063						11,063
2,4-DB, linuron, MCPA	408						408	422						422
2,4-DB, MCPA	4,121			2,776			6,897	5,296			4,777			10,073
2,4-DB, mecoprop-P	1,128						1,128	1,466						1,466
aclonifen			237				237			89				89
amidosulfuron	26,240			743			26,983	790			25			815
asulam	7,105						7,105	5,410						5,410
atrazine		14,166					14,166		24,152					24,152
bentazone, MCPB				666			666				1,132			1,132
bromoxynil		3,834					3,834		1,557					1,557
carfentrazone-ethyl, metsulfuron (-methyl)				2,499			2,499				56			56
clopyralid		89	824				913		9	45				54
clopyralid, fluroxypyr, triclopyr	2,584						2,584	1,870						1,870
clopyralid, triclopyr	27						27	33						33
desmedipham, ethofumesate, phenmedipham			3,125				3,125			778				778
dicamba, MCPA, mecoprop	5,099						5,099	11,804						11,804
dicamba, MCPA, mecoprop-P	4,978			208			5,186	8,322			284			8,606
dicamba, mecoprop	265						265	125						125
dicamba, mecoprop-P	5,156						5,156	4,762						4,762
dichlorprop	1,573						1,573	1,461						1,461

Table 24: Grassland and fodder crops areas and quantities of active substances continued

	Areas (spray hectares) treated with each active substance or active substance combination in overall treatments							**Quantities** (kilograms) of each active substance or active substance combination applied in overall treatments						
	Agriculture- Crop						**Total**	**Crop**						**Total**
Active substance/combination	Grass	Maize	Fodder beet	Arable silage	Swedes/ Turnips	Kale/ Rape		Grass	Maize	Fodder beet	Arable silage	Swedes/ Turnips	Kale/ Rape	
dichlorprop, MCPA, mecoprop-P	5,574						5,574	10,688						10,688
diflufenican, isoproturon				349			349				209			209
ethofumesate, metamitron, phenmedipham			44				44			9				9
ethofumesate, phenmedipham			2,810				2,810			1,178				1,178
fluazifop-P (-butyl)		162	139				301		6	11				17
fluroxypyr	2,416	270					2,686	423	108					531
fluroxypyr, triclopyr	25,888						25,888	11,185						11,185
glyphosate	52,856	1,760	139	5,988	142	247	61,132	73,939	2,379	91	8,605	167	334	85,515
glyphosate trimesium	197						1,976	426						426
haloxyfop-R			225				225			13				13
iodosulfuron-methyl-sodium				1,165			1,165				9			9
isoproturon				349			349				174			174
lenacil			2,493				2,493			571				571
MCPA	113,114			2,037			115,151	181,823			858			182,681
mecoprop	5,227			744			5,971	8,572			1,328			9,900
mecoprop-P	37,906			1,803			39,709	60,000			1,670			61,670
metamitron			3,654				3,654			2,882				2,882
metazachlor					300		300					193		193
metsulfuron (-methyl)	711			562			1,273	3			2			5
metsulfuron (-methyl), thifensulfuron (-methyl)				403			403				21			21
pendimethalin		5,684		422			6,106		7,627		626			8,253
propachlor					76	17	93					450	99	549
propaquizafop			239				239			30				30
pyridate		1,484					1,484		1,005					1,005
quizalofop-P			130				130			24				24

Table 24: Grassland and fodder crops areas and quantities of active substances continued

	Areas (spray hectares) treated with each active substance or active substance combination in overall treatments .							**Quantities** (kilograms) of each active substance or active substance combination applied in overall treatments						
	Agriculture- Crop						**Total**	**Crop**						**Total**
Active substance/combination	Grass	Maize	Fodder beet	Arable silage	Swedes/ Turnips	Kale/ Rape		Grass	Maize	Fodder beet	Arable silage	Swedes/ Turnips	Kale/ Rape	
rimsulfuron		10					10		0+					0
terbuthylazine, terbutryn				2,240			2,240				2,798			2,798
thifensulfuron (-methyl)	13,742						13,742	195						195
tribenuron (-methyl)				383			383				4			4
triclopyr	587						587	568						568
trifluralin					715	40	755					609	44	653
triflusulfuron (-methyl)			3,129				3,129			65				65
Fungicides														
azoxystrobin				4,728			4,728				937			937
carbendazim, flusilazole			752	1,144			1,896			433	140			573
chlorothalonil				10,456			10,456				6,903			6,903
cyproconazole			80				80			5				5
cyproconazole, propiconazole				403			403				95			95
cyprodinil, propiconazole				365			365				118			118
epoxiconazole				9,695			9,695				925			925
epoxiconazole, fenpropimorph				282			282				129			129
epoxiconazole, kresoxim methyl				2,078			2,078				267			267
fenpropidin				2,901			2,901				1,079			1,079
fenpropimorph				966	43		1,009				357	29		386
flusilazole			127				127			14				14
mancozeb, metalaxyl					317		317					571		571
prochloraz				2,037			2,037				566			566
tebuconazole				1,165			1,165				233			233
Insecticides														
bendiocarb			50				50			14				14

Table 24: Grassland and fodder crops areas and quantities of active substances continued

	Areas (spray hectares) treated with each active substance or active substance combination in overall treatments							**Quantities** (kilograms) of each active substance or active substance combination applied in overall treatments						
Active substance/combination	**Agriculture- Crop**						**Total**	**Crop**						**Total**
	Grass	Maize	Fodder beet	Arable silage	Swedes/ Turnips	Kale/ Rape		Grass	Maize	Fodder beet	Arable silage	Swedes/ Turnips	Kale/ Rape	
carbofuran		952	137		99		1,189		362	67		43		472
carbofuran, isofenphos					67		67					55		55
chlorpyrifos	327				77	49	452	235				52	49	336
cypermethrin				2847	32	49	2,928				71	1	1	73
deltamethrin					11		11					0*		0
dimethoate				2009			2,009				458			458
esfenvalerate			80	3601	26		3,707			1	15	0*		16
oxydemeton-methyl			79				79			10				10
pirimicarb					159		159					20		20
Growth regulators														
chlormequat				5668			5,668				5,490			5,490
chlormequat, choline chloride, imazaquin				2037			2,037				2,021			2,021
ethephon, mepiquat				1567			1,567				892			892
Seed treatments														
carboxin, fludioxonyl, guazatine, imazalil, tebuconazole, thiram				1975			1,975				155			155
carboxin, guazatine, imazalil, thiram				11093			11,093				809			809
carboxin, guazatine, thiram				1101			1,101				41			41
carboxin, thiram				917			917				96			96
fludioxonyl		11694					11,694		13					13
fludioxonyl, guazatine				280			280				10			10
fludioxonyl, metalaxyl-M		5474					5,474		4					4
fludioxonyl, metalaxyl, metalaxyl-M, methiocarb		1164					1,164		83					83
guazatine				4152			4,152				380			380

Table 24: Grassland and fodder crops areas and quantities of active substances continued

	Areas (spray hectares) treated with each active substance or active substance combination in overall treatments							**Quantities** (kilograms) of each active substance or active substance combination applied in overall treatments						
Active substance/combination	**Agriculture- Crop**						**Total**	**Crop**						**Total**
	Grass	Maize	Fodder beet	Arable silage	Swedes/ Turnips	Kale/ Rape		Grass	Maize	Fodder beet	Arable silage	Swedes/ Turnips	Kale/ Rape	
guazatine, imazalil				5149			5,149				440			440
hymexazol			2,955			244	3,199			46			10	56
iprodione					1200		1,200					7		7
metalaxyl		3655					3,655		2					2
methiocarb		13341	2,955			244	16,540		1,832	22			5	1,859
thiram			2,955		1200	244	4,399			26		8	6	40
Molluscicides														
methiocarb		878	153				1,031		47	18				65
Total							537517							516239

Table 25: Areas (spray hectares) treated with each active substance or active substance combination (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoe	Set-aside	Non-food	Lupins	Sugar beet	Total
Herbicides																
2,4-DB, benazolin (-ethyl), MCPA	549															549
2,4-DB, MCPA	810															810
amidosulfuron	1,058	381		3,841		1,011							126			6,417
bromoxynil, fluroxypyr, ioxynil	1,211															1,211
bromoxynil, ioxynil	4,920	185	656		514								126			6,402
carfentrazone-ethyl, metsulfuron (-methyl)	11,836	133		1,065						162						13,195
clodinafop			3,317	13,203												16,520
clopyralid															10,027	10,027
cyanazine															1,194	1,194
cycloxydim															3,050	3,050
desmedipham, ethofumesate, phenmedipham															44,445	44,445
dicamba, MCPA, mecoprop-P	5,076		357		202											5,636
dicamba, mecoprop-P	9,125	634		1,473												11,232
dichlorprop	8,265				847											9,112
dichlorprop-P, ioxynil	518															518
diflufenican, flurtamone						3,509										3,509
diflufenican, isoproturon		18,266		44,453									121			62,840
diquat (dibromide)							347				14,039				149	14,535
diquat (dibromide), paraquat											119					119
ethofumesate															4,437	4,437
ethofumesate, phenmedipham															26,758	26,758
fenoxaprop (ethyl)	2,014		913	3,225												6,152
fenoxaprop-P (ethyl)	12,823	2,166	3,718	9,166												27,874
flamprop-M (isopropyl)	2,345	568														2,913
florasulam				3,452	424	1,105										4,980
fluazifop-P (-butyl)															1,848	1,848
fluroxypyr	10,611		2,132	8,325	501	740										22,308
glyphosate	48,128	7,981	9,973	45,035	2,218	5,980	984		603		1,953	5,768	121	67	12,202	141,01

Table 25: Areas (spray hectares) treated with each active substance or active substance combination (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoe	Set-aside	Non-food	Lupins	Sugar beet	Total
haloxyfop-R															923	923
iodosulfuron-methyl-sodium	6,448		252	1,287												7,988
isoproturon	3,222	12,874	3,256	50,244					202				248			70,045
isoproturon, pendimethalin				11,899												11,899
lenacil															31,869	31,869
linuron											340					340
MCPA	6,145	3,678	749	915	127							877				12,492
mecoprop	10,863		1,603		330											12,796
mecoprop-P	109,947	827	20,846	5,463	1,110	5,072				98						143,361
metamitron															39,370	39,370
metribuzin											9,637					9,637
metsulfuron (-methyl)	37,632	478	15,591	3,265	3,328	2,089				73		475				62,931
metsulfuron (-methyl), thifensulfuron (-methyl)	40,813		6,041	1,856						98			126			48,934
metsulfuron (-methyl), tribenuron (-methyl)	15,951		2,892		386	1,352										20,581
paraquat	940								707		10,300					11,946
pendimethalin				1,166										44		1,210
propachlor											25					25
propaquizafop											19				4,970	4,988
propyzamide							320									320
quizalofop-P															157	157
rimsulfuron											381					381
simazine									1,932		3,320					5,251
sulfosulfuron				940												940
sulphuric acid											952					952
terbuthylazine, terbutryn								320								320
thifensulfuron (-methyl), tribenuron (-methyl)	17,935		1,856													19,791
tralkoxydim	20,041	1,739														21,780
tribenuron (-methyl)	29,376	1,022	3,472	3,920	424	3,844										42,059

Table 25: Areas (spray hectares) treated with each active substance or active substance combination (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoe	Set-aside	Non-food	Lupins	Sugar beet	Total
triflusulfuron (-methyl)															40,413	40,413
unknown herbicide	795										74					869
Fungicides																
azoxystrobin	45,407	7,240	21,549	55,806	1,791	7,154		325	452				126	12		139,864
azoxystrobin, fenpropimorph	2,981	455	582	2,381		1,235							121			7,754
benalaxyl, mancozeb									111		1,423					1,534
bromuconazole	519															519
carbendazim	4,486		656	3,087					2,389							10,618
carbendazim, flusilazole	104,209	6,545	1,298	1,216	544										17,924	131,736
chlorothalonil	138,387	30,458	26,920	145,574		3,130		480	3,191		939		490	12		349,582
chlorothalonil, flutriafol			1,992	9,476												11,468
copper oxychloride											93					93
cyazofamid											4,663					4,663
cymoxanil											10,703					10,703
cymoxanil, famoxodone											360					360
cymoxanil, mancozeb											8,929					8,929
cymoxanil, mancozeb, oxadixyl											2,315					2,315
cyproconazole	1,209		4,044		395										455	6,102
cyproconazole, cyprodinil	1,164															1,164
cyproconazole, prochloraz				9,867									126			9,993
cyproconazole, propiconazole	8,346		2,890	10,006	745	2,779										24,766
cyproconazole, trifloxystrobin		568	1,383	8,752		5,866										16,568
cyprodinil		347		3,881												4,228
cyprodinil, propiconazole	16,212	7,660														23,872
difenoconazole	1,567		984	969											1,109	4,629
dimethomorph, mancozeb											5,820					5,820
dimoxystrobin, epoxiconazole			548	3,844												4,392
dithianon											316					316
epoxiconazole	43,877	13,819	30,285	112,93	100	1,050							121			202,19

Table 25: Areas (spray hectares) treated with each active substance or active substance combination (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoe	Set-aside	Non-food	Lupins	Sugar beet	Total
				8												0
epoxiconazole, fenpropimorph	2,432	397		4,597												7,425
epoxiconazole, fenpropimorph, kresoxim methyl	3,510				490	1,352										5,352
epoxiconazole, kresoxim methyl	50,232	5,534	7,698	9,139	1,282	5,111										78,996
epoxiconazole, kresoxim methyl, pyraclostrobin	1,667															1,667
famoxodone, flusilazole	4,735	2,680														7,415
fenpropidin	13,851		7,037	5,278	169	1,755										28,091
fenpropidin, fenpropimorph						289										289
fenpropidin, propiconazole, tebuconazole	1,157															1,157
fenpropidin, tebuconazole						566										566
fenpropimorph	117,597	8,242	18,764	21,477	4,883	5,705							126	32		176,825
fenpropimorph, flusilazole	4,140															4,140
fenpropimorph, propiconazole	1,373															1,373
fenpropimorph, quinoxyfen	9,158	544	779	3,653	1,418	12,812										28,364
fentin hydroxide											6,055					6,055
fluazinam											57,194					57,194
fluazinam, metalaxyl M											251					251
fluquinconazole			1,195	10,445									121			11,762
fluquinconazole, prochloraz			1,002	8,537												9,540
flusilazole	23,340	7,153	1,402													31,896
iprodione									263							263
mancozeb				915					381		40,821					42,116
mancozeb, metalaxyl							182				1,928					2,109
mancozeb, metalaxyl M											11,319					11,319
mancozeb, propamocarb											2,946					2,946
mancozeb, zoxamide											6,119					6,119
maneb											897					897
metconazole			1,297	6,337												7,635

Table 25: Areas (spray hectares) treated with each active substance or active substance combination (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoe	Set-aside	Non-food	Lupins	Sugar beet	Total
picoxystrobin	34,815	6,895	504	619												42,833
prochloraz		3,121	1,426	24,309									121			28,977
propamocarb											292					292
propiconazole	7,669	506		8,359		380								32	455	17,401
pyraclostrobin	415	478	968	2,762												4,623
quinoxyfen	2,644		1,738			1,111										5,492
spiroxamine	2,773		996			1,352										5,120
spiroxamine, tebuconazole	5,939	568	6,353	23,613	3,090	5,717	187									45,467
tebuconazole	1,237	132	3,450	13,207	1,253	3,296	409		213				126			23,323
trifloxystrobin	11,255	3,989	437	4,965									121			20,767
dimethoate	13,185	3,678	9,931	39,446	1,337	3,179	187	77	554		4,538		121		1,620	77,853
esfenvalerate	76,907	16,479	21,089	56,216	2,123	8,916	205		263		125		312		640	183,275
lambda-cyhalothrin	4,412	2,561		6,469	501	2,020					942		121			17,026
oxydemeton-methyl	4,132		3,548	4,817					250		9,223				537	22,506
pirimicarb	1,075							160	111		2,689					4,035
triazamate						249					62					310
unknown insecticide	61															61
Growth regulators																
chlormequat	4,737	9,148	27,827	65,346	4,655	25,306							248			137,266
chlormequat, cholin chloride, imazaquin		680	911	16,313												17,904
dimethipin											355					355
ethephon	2,179	5,264	1,727	915		359										10,444
ethephon, mepiquat chloride		1,930	4,944	9,118	424											16,416
maleic hydrazide											106					106
trinexapac ethyl	1,336	1,183		3,110	1,719	5,882							126			13,355
Seed treatments																
beta-cyfluthrin, imidacloprid							1,215			260			50			1,525
carboxin, thiram	43,600	5,883	2,038	3,917	501	957										56,896

Table 25: Areas (spray hectares) treated with each active substance or active substance combination (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoe	Set-aside	Non-food	Lupins	Sugar beet	Total
cymoxanil, fludioxonil, metalaxyl M								320								320
guazatine	3,291		23,126	65,295	682	283							248			92,925
guazatine, imazalil	112,333	14,464	289		2,928	10,772										140,786
imazalil											9,897					9,897
imazalil, pencycuron											1,026					1,026
imazalil, tebuconazole	4,702															4,702

Table 26: Quantities (kilograms) of each active substance or active substance combination applied (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoes	Set-aside	Non-food	Lupins	Sugar beet	Total
Herbicides																
2,4-DB, benazolin (-ethyl), MCPA	1,181															1,181
2,4-DB, MCPA	1,587															1,587
amidosulfuron	32	8		73		13							1			127
bromoxynil, fluroxypyr, ioxynil	246															246
bromoxynil, ioxynil	1,920	97	216		288								76			2,596
carfentrazone-ethyl, metsulfuron (-methyl)	596	3		7						2						607
clodinafop			395	274												669
clopyralid															808	808
cyanazine															205	205
cycloxydim															414	414
desmedipham, ethofumesate, phenmedipham															11,137	11,137
dicamba, MCPA, mecoprop-P	2,791		223		277											3,291
dicamba, mecoprop-P	4,930	111		504												5,545
dichlorprop	6,276				1,270											7,546
dichlorprop-P, ioxynil	797															797
diflufenican, flurtamone						837										837
diflufenican, isoproturon		14,491		35,012									91			49,595
diquat (dibromide)							161				6,695				30	6,886
diquat (dibromide), paraquat											71					71
ethofumesate															1,674	1,674
ethofumesate, phenmedipham															10,017	10,017
fenoxaprop (ethyl)	61		45	81												187
fenoxaprop-P (ethyl)	456	82	221	459												1,219
flamprop-M (isopropyl)	664	67														730
florasulam				14	2	7										23
fluazifop-P (-butyl)															202	202
fluroxypyr	2,621		204	1,388	60	148										4,420
glyphosate	40,733	6,084	7,834	28,596	1,720	4,236	759		542		2,458	8,012	153	56	13,481	114,664
haloxyfop-R															14	14
iodosulfuron-methyl-sodium	42		2	8												51

Table 26: Quantities (kilograms) of each active substance or active substance combination applied (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoes	Set-aside	Non-food	Lupins	Sugar beet	Total
isoproturon	2,689	8,051	2,733	39,455					143				155			53,227
isoproturon, pendimethalin				26,592												26,592
lenacil															6,446	6,446
linuron											190					190
MCPA	3,529	1,183	528	848	48							1,097				7,232
mecoprop	7,759		1,044		188											8,992
mecoprop-P	82,544	619	16,609	2,803	726	3,039				97						106,436
metamitron															29,113	29,113
metribuzin											7,538					7,538
metsulfuron (-methyl)	197	2	1,656	16	16	8				1		3				1,898
metsulfuron (-methyl), thifensulfuron (-methyl)	1,125		149	42						4			1			1,321
metsulfuron (-methyl), tribenuron (-methyl)	210		104		6	17										337
paraquat	423								111		4,400					4,934
pendimethalin				1,382										50		1,432
propachlor											5					5
propaquizafop											3				375	378
propyzamide							205									205
quizalofop-P															10	10
rimsulfuron											5					5
simazine									1,949		3,628					5,576
sulfosulfuron				0												0
sulphuric acid											147,059					147,059
terbuthylazine, terbutryn								341								341
thifensulfuron (-methyl), tribenuron (-methyl)	459		47													507
tralkoxydim	4,454	522														4,976
tribenuron (-methyl)	16,971	20	2,975	62	4	59										20,091
triflusulfuron (-methyl)															1,050	1,050

Table 26: Quantities (kilograms) of each active substance or active substance combination applied (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoes	Set-aside	Non-food	Lupins	Sugar beet	Total
Fungicides																
azoxystrobin	6,249	1,180	2,894	8,243	273	982		47	85				6	3		19,961
azoxystrobin, fenpropimorph	973	135	177	1,096		730							58			3,169
benalaxyl, mancozeb									167		2,225					2,392
bromuconazole	104															104
carbendazim	993		135	2,157					1,043							4,328
carbendazim, flusilazole	17,623	1,613	239	730	386										3,886	24,477
chlorothalonil	76,159	13,657	13,162	72,664		1,729		484	2,543		1,101		245	6		181,751
chlorothalonil, flutriafol			1,631	8,808												10,440
copper oxychloride											231					231
cyazofamid											512					512
cymoxanil											1,279					1,279
cymoxanil, famoxodone											92					92
cymoxanil, mancozeb											25,465					25,465
cymoxanil, mancozeb, oxadixyl											4,048					4,048
cyproconazole	48		162		18										14	242
cyproconazole, cyprodinil	272															272
cyproconazole, prochloraz				3,560									46			3,607
cyproconazole, propiconazole	1,042		325	1,383	115	427										3,292
cyproconazole, trifloxystrobin		45	286	1,281		1,201										2,813
cyprodinil		104		1,320												1,424
cyprodinil, propiconazole	5,196	4,173														9,369
difenoconazole	52		101	121											107	381
dimethomorph, mancozeb											10,496					10,496
dimoxystrobin, epoxiconazole			75	644												719
dithianon											356					356
epoxiconazole	3,137	991	2,637	10,373	10	92							5			17,244
epoxiconazole, fenpropimorph	756	179		1,538												2,473
epoxiconazole, fenpropimorph, kresoxim methyl	797				69	152										1,018
epoxiconazole, kresoxim methyl	8,209	1,117	1,233	1,364	179	661										12,764
epoxiconazole, kresoxim methyl, pyraclostrobin	625															625

Table 26: Quantities (kilograms) of each active substance or active substance combination applied (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoes	Set-aside	Non-food	Lupins	Sugar beet	Total
famoxodone, flusilazole	727	692														1,420
fenpropidin	5,454		1,820	1,255	51	764										9,345
fenpropidin, fenpropimorph						72										72
fenpropidin, propiconazole, tebuconazole	268															268
fenpropidin, tebuconazole						116										116
fenpropimorph	37,000	2,853	6,130	7,553	2,117	1,417							47	8		57,125
fenpropimorph, flusilazole	1,511															1,511
fenpropimorph, propiconazole	485															485
fenpropimorph, quinoxyfen	1,542	85	123	792	446	3,330										6,318
fentin hydroxide											4,458					4,458
fluazinam											11,121					11,121
fluazinam, metalaxyl M											75					75
fluquinconazole			161	1,251									15			1,426
fluquinconazole, prochloraz			330	5,482												5,812
flusilazole	2,591	885	224													3,700
iprodione									42							42
mancozeb				1,464					802		80,474					82,740
mancozeb, metalaxyl							170				2,802					2,972
mancozeb, metalaxyl M											18,689					18,689
mancozeb, propamocarb											5,493					5,493
mancozeb, zoxamide											14,041					14,041
maneb											3,200					3,200
metconazole			59	335												394
picoxystrobin	4,974	918	62	109												6,063
prochloraz		971	495	8,647									44			10,156
propamocarb											221					221
propiconazole	775	31		522		24								2	34	1,389
pyraclostrobin	43	59	120	276												498
quinoxyfen	113		131			97										341
spiroxamine	883		747			380										2,009
spiroxamine, tebuconazole	1,594	115	1,880	9,073	1,068	2,187	53									15,971

Table 26: Quantities (kilograms) of each active substance or active substance combination applied (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoes	Set-aside	Non-food	Lupins	Sugar beet	Total
tebuconazole	214	6	406	1,910	207	508	62		27				24			3,364
trifloxystrobin	1,530	397	27	470									11			2,435
Insecticides																
alpha-cypermethrin				37							52					89
bifenthrin	8															8
carbofuran															1,199	1,199
carbofuran, isofenphos															90	90
chlorpyrifos	2,984		109	446											311	3,850
cypermethrin	1,530	55	253	328	35	46		2			26					2,274
deltamethrin	40	6	4	43							1				27	120
dimethoate	3,865	686	2,475	7,860	134	950	65	29	144		903		29		451	17,592
esfenvalerate	395	75	109	216	9	39	1		1		1		2		2	850
lambda-cyhalothrin	11	28		20	3	13					55		1			131
oxydemeton-methyl	234		421	456					11		854				111	2,086
pirimicarb	134							16	15		509					674
triazamate						7					4					11
Growth regulators																
chlormequat	2,902	7,713	26,928	78,433	4,532	26,083							324			146,915
chlormequat, cholin chloride, imazaquin		226	367	8,597												9,189
dimethipin											174					174
ethephon	553	1,037	412	358		256										2,616
ethephon, mepiquat chloride		1,020	1,944	4,299	293											7,555
maleic hydrazide											419					419
trinexapac ethyl	100	71		155	43	193							5			567
Seed treatments																
beta-cyfluthrin, imidacloprid							28			40			2			70
carboxin, thiram	6,902	1,119	405	709	97	176										9,408
cymoxanil, fludioxonil, metalaxyl M								31								31
guazatine	299		2,197	6,518	90	35							28			9,166
guazatine, imazalil	10,878	1,417	29		488	1,709										14,521

Table 26: Quantities (kilograms) of each active substance or active substance combination applied (excluding field margin treatments)

	Crop															
Active substance/combination	Spring barley	Winter barley	Spring wheat	Winter wheat	Spring oats	Winter oats	Oilseed rape	Peas	Beans	Linseed	Potatoes	Set-aside	Non-food	Lupins	Sugar beet	Total
imazalil, tebuconazole	38															38
imidacloprid															1,611	1,611
iprodione											4					0
methiocarb															71	71
prochloraz										1						1
propamocarb															457	457
silthiofam		64	181	665												910
thiabendazole											10					10
thiabendazole, thiram														10		10
thiram							32		618				2		190	842
Molluscicides																
metaldehyde											267					267
methiocarb		105		170			53				1,654				2,183	4,164
thiodicarb											84					84
All Pesticides	**398,102**	**75,166**	**106,594**	**401,344**	**15,269**	**52,739**	**1,590**	**950**	**8,242**	**146**	**363,756**	**9,112**	**1,371**	**134**	**85,720**	**1,520,584**

Table 27: Usage of Priority Substances from questionnaire results

Nace Code	NACE Classification Name	Nickel	Cadmium	Mercury	Lead	Chlorpyrifos	Diuron	Isoproturon	Benzene	Nonylphenol	Dichloromethane	Trichloromethane	1,2- dichlorethane	Di-(2-ethyl hexyl) phthalate	Tetrachloroethylene
CB.0.00	Mining and quarrying, except of energy producing materials				x										
DF.23.20	Manufacture of refined petroleum products		x												x
DG.24.13	Manufacture of other inorganic basic chemicals	x			x					x					
DG.24.14	Manufacture of other organic basic chemicals									x	x			x	
DG.24.20	Manufacture of pesticides and other agro-chemical products				x					x	x				
DG.24.42	Manufacture of pharmaceutical preparations	x		x	x	x			x		x	x	x	x	
DI.26.10	Manufacture of glass and glass products				x										
DI.26.50	Manufacture of cement, lime and plaster			x											
DJ.27.00	Manufacture of basic metals	x			x										
DJ.27.42	Aluminium production	x	x	x	x										
DJ.27.54	Casting of other non-ferrous metals				x										
DJ.28.50	Treatment and coating of metals; general mechanical engineering	x	x		x										
DK.29.56	Manufacture of other special purpose machinery n.e.c	x			x			x			x				
DL.30.02	Manufacture of computers and other information processing equipment	x			x		x				x				
DN.37.2	Recycling of non-metal waste and scrap														x

Table 28: Usage of Candidate Relevant Pollutants from questionnaire results

Nace Code	Arsenic	Benzylchloride (Alpha-chlorotoluene)	Biphenyl	2-Chloroaniline	2-Chloroethanol	2-Chloroethanol	2-Chlorotoluene	1,1-Dichloroethane	Diethylamine	Dimethoate	Dimethylamine	Epichlorohydrin	Ethyl benzene	Mecoprop	1,1,2,2-Tetrachloroethane	1,1,2,2-Tetrachloroethane	Toluene	1,1,1-Trichloroethane	Xylenes	Zinc	Copper and compounds	Chromium and compounds	Antimony	Boron	Silver	Fluorides	Permethrin	PCDD + PCDF	Chlorides	Phenols	Chlormequat	Ferrous Sulphate	Glyphosate	Metamitron	Paraquat	Bromoxynil	Ethofumesate	Prochloraz	Styrene	Di-n-butylphthalate (DBP)	Ethinyl Oestradiol	Oestradiol	Methybromide (bromomethane)	Progesterone	Cyanide
CB.0.00																				x																									
DB.17.0																			x																										
DG.24.14			x														x			x	x																							
DG.24.20																	x			x	x					x			x		x									x				
DG.24.30													x				x		x	x																								
DG.24.42	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x			x		x	x	x	x	x	x	x	x		x	x	x	x	x
DH.25.1															x	x	x			x																									
DJ.27.00																				x		x	x			x			x																
DJ.27.42	x																			x																									
DJ.28.50				x													x																											
DK.29.56																	x		x		x								x																
DL.30.02	x																				x	x				x			x															x
DJ.27.42																					x	x																						
DI.26.50																						x																						
DG.24.13																					x								x		x													
DG.24.42																																							x						x
DF.23.20																						x																	x					
CB.0.00																					x										x													
DA.15.1																															x													
DJ.28.50																					x	x			x				x															X

Table 29: NACE codes

Nace Code	NACE Classification Name
CB.0.00	Mining and quarrying, except of energy producing materials
DB.17.0	Manufacture of textiles
DG.24.14	Manufacture of other organic basic chemicals
DG.24.20	Manufacture of pesticides and other agro-chemical products
DG.24.30	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
DG.24.42	Manufacture of pharmaceutical preparations
DH.25.1	Manufacture of rubber products
DJ.27.00	Manufacture of basic metals
DJ.27.42	Aluminium production
DJ.28.50	Treatment and coating of metals; general mechanical engineering
DK.29.56	Manufacture of other special purpose machinery n.e.c
DL.30.02	Manufacture of computers and other information processing equipment
DJ.27.42	Aluminium production
DI.26.50	Manufacture of cement, lime and plaster
DG.24.13	Manufacture of other inorganic basic chemicals
DF.23.20	Manufacture of refined petroleum products
CB.0.00	Mining and quarrying, except of energy producing materials
DA.15.1	Production, processing and preserving of meat and meat products
DJ.28.50	Treatment and coating of metals; general mechanical engineering

Table 30: Discharges to water of Candidate Relevant Pollutants from questionnaire results

Nace Code	NACE Classification Name	Antimony	Arsenic and compounds	Barium	Benzylchloride (Alpha-chlorotoluene)	Beryllium	Boron	Chlorides	Chromium and compounds	Cobalt	Copper and compounds	Cyanide	Ethyl benzene	Fluorides	PCDD + PCDF	Phenols	Selenium	Silver	Titanium	Toluene	Vinyl chloride	Xylenes	Zinc and compounds
CB.0.00	Mining and quarrying, except of energy producing materials		x	x					x	x	x												X
DB.17.0	Manufacture of textiles	x	x	x		x	x		x		x						x						X
DF.23.20	Manufacture of refined petroleum products		x						x		x		x			x				x	x	x	X
DG.24.42	Manufacture of pharmaceutical preparations		x		x		x	x	x		x	X		x	x		x	x		x			X
DH.25.1	Manufacture of rubber products																						X
DI.26.50	Manufacture of cement, lime and plaster								x														
DJ.27.00	Manufacture of basic metals	x																	x				
DJ.27.54	Casting of other non-ferrous metals		x						x		x												

Table 31: Discharges to Sewer of Candidate Relevant Pollutants from questionnaire results

Nace Code	NACE Classification Name	Arsenic and compounds	Toluene	Xylenes	Zinc and compounds	Copper and compounds	Chromium and compounds	Selenium	Boron	Cobalt	Fluorides	Chlorides	Phenols	Ethinyl Oestradiol	Cyanide
DA.15.91	Manufacture of distilled potable alcoholic beverages				x	x									
DF.23.20	Manufacture of refined petroleum products						x								
DG.24.13	Manufacture of other inorganic basic chemicals				x	x	x			x		x			
DG.24.14	Manufacture of other organic basic chemicals				x	x						x			
DG.24.20	Manufacture of pesticides and other agro-chemical products		x		x										
DG.24.42	Manufacture of pharmaceutical preparations	x	x	x	x	x	x	x	x			x		x	x
DI.26.10	Manufacture of glass and glass products												x		
DJ.27.00	Manufacture of basic metals				x		x				x	x			
DJ.28.50	Treatment and coating of metals; general mechanical engineering				x	x				x		x			
DK.29.56	Manufacture of other special purpose machinery n.e.c				x	x	x					x			
DL.30.02	Manufacture of computers and other information processing equipment	x					x								x

Table 32: Discharges to Sewer of Priority Substances from questionnaire results

Nace Code	NACE Classification Name	Cadmium and compounds	Nickel and compounds	Mercury and compounds	Lead and compounds	Nonylphenols	Dichloromethane	Trichloromethane	1,2-dichloroethane
DA.15.91	Manufacture of distilled potable alcoholic beverages				x				
DF.23.20	Manufacture of refined petroleum products	x							
DG.24.13	Manufacture of other inorganic basic chemicals		x		x				
DG.24.20	Manufacture of pesticides and other agro-chemical products						x		
DG.24.42	Manufacture of pharmaceutical preparations	x	x	x	x	x	x	x	x
DI.26.10	Manufacture of glass and glass products				x				
DJ.27.00	Manufacture of basic metals		x						
DJ.28.50	Treatment and coating of metals; general mechanical engineering		x						
DK.29.56	Manufacture of other special purpose machinery n.e.c		x		x				
DL.30.02	Manufacture of computers and other information processing equipment		x		x				

Table 33: Discharges to Water of Priority Substances from questionnaire results

Nace Code	NACE Classification Name	Cadmium and compounds	Mercury and compounds	Nickel and compounds	Lead and compounds	Benzene	Trichloroethylene	Tetrachloroethylene (PER)	Dichloromethane (DCM)	Naphthalene
CB.0.00	Mining and quarrying, except of energy producing materials	x	x	x	x					
DA.15.91	Manufacture of distilled potable alcoholic beverages				x					
DB.17.0	Manufacture of textiles	x	x	x	x					
DF.23.20	Manufacture of refined petroleum products	x	x	x	x	x	x	x		x
DG.24.13	Manufacture of other inorganic basic chemicals				x					
DG.24.42	Manufacture of pharmaceutical preparations	x	x	x	x				x	
DI.26.10	Manufacture of glass and glass products				x					
DJ.27.00	Manufacture of basic metals			x	x					
DJ.27.54	Casting of other non-ferrous metals			x	x					
DK.29.56	Manufacture of other special purpose machinery n.e.c									

Table 34: Candidate Relevant Pollutant Substances list shown on DEFRA or questionnaire data

List of Substances	CAS Number	DEFRA	Questionnaire Usage	Questionnaire discharges
Arsenic and its mineral compounds	7440-38-2	X	X	X
Benzidine	92-87-5	X		
Biphenyl	92-52-4		X	
Chloral hydrate	302-17-0		X	
Chloroacetic acid	79-11-8		X	
Mono-Chlorobenzene	108-90-7	X		
2-Chloroethanol	107-07-3		X	
Diethylamine	109-89-7		X	
Dimethylamine	124-40-3	X		
Epichlorohydrin	106-89-8	X		
Linuron	330-55-2	X		
Mecoprop	93-65-2, 7085-19-0		X	
PCB (including PCT)	n/a	X		
1,2,4,5-Tetrachlorobenzene	95-94-3		X	
1,1,2,2-Tetrachloroethane	79-34-5		X	
Toluene	108-88-3		X	X
Tributyl phosphate	126-73-8	X		
Xylenes (technical mixture of isomers)	1330-20-7	X	X	X
Malathion	121-75-5	X		
Zinc	7440-66-6		X	X
Copper	7440-50-8	X	X	X
Chromium	7440-47-3	X	X	X
Selenium	7782-49-2	X	X	X
Antimony	7440-36-0	X		X
Molybdenum	7439-98-7	X	X	
Titanium	7440-32-6	X	X	X
Tin	7440-31-5	X		
Barium	7440-39-3	X	X	X
Beryllium	7440-41-7	X	X	X
Boron	7440-42-8	X	X	X
Uranium	7440-61-1	X		
Vanadium	7440-62-2	X		
Cobalt	7440-48-4	X	X	
Thallium	7440-28-0	X		
Tellurium	1349-80-9	X		
Silver	7440-22-4	X	X	X
Cyanide	57-12-5	X		X
Fluorides	16984-48-8	X	X	X
Permethrin	52645-53-1	X		
PCDD	n/a		X	X
PCDF	n/a		X	X
Chloride	16887-00-6	X		X

Table 34: Candidate Relevant Pollutant Substances List shown on DEFRA or questionnaire data continued

List of Substances	CAS Number	DEFRA	Questionnaire Usage	Questionnaire discharges
Phenols	n/a			X
Chlormequat	7003-89-6		X	
Cypermethrin	52315-07-8/ 66841-24-5	X		
Ferrous Sulphate	7720-78-7	X	X	
Glyphosate	1071-83-6		X	
Glyphosate trimesium	81591-81-3		X	
Maneb	124727-38-2	X		
Metamitron	41394-05-2		X	
Metam-sodium	137-42-8 / 6734-80-1 for dihydrate		X	
Metazachlor	67129-08-2		X	
Oxamyl	23135-22-0		X	
Paraquat	1910-42-5 for dichloride salt / 4685-14-7 for dictation	X		
Bromoxynil	1689-84-5		X	
Cyfluthrin	68359-37-5	X		
Ethofumesate	26225-79-6		X	
Styrene	100-42-5		X	
Ethinyl Oestradiol	57-63-6		X	X
Oestradiol	50-28-2		X	
Methybromide (bromomethane)	74-83-9		X	
Ethyl Benzene	100-41-4			X
Vinyl chloride	75-01-4			X
Progesterone	n/a		X	

Table 35: PRTR list of substances

PRTR	CAS No.	Substance	Priority Substance	Relevant Pollutant	EQS Proposed	Comment
1	74-82-8	Methane				Air
2	630-08-0	Carbon monoxide (CO				Air
3	124-38-9	Carbon dioxide (CO2)				Air
4		Hydro-fluorocarbons (HFCs)				Air
5	10024-97-2	Nitrous oxide (N2O)				Air
6	7664-41-7	Ammonia (NH3)				Air
7		Non-methane volatile organic compounds (NMVOC)				Air
8		Nitrogen oxides (NOx/NO2)				Air
9		Perfluorocarbons (PFCs)				Air
10	2551-62-4	Sulphur hexafluoride (SF6)				Air
11		Sulphur oxides (SOx/SO2)				Air
12		Total nitrogen				
13		Total phosphorus				General Component
14		Hydrochlorofluorocarbons (HCFCs)				Air
15		Chlorofluorocarbons (CFCs)				Air
16		Halons				Air
17		Arsenic and compounds (as As)		x	x	
18		Cadmium and compounds (as Cd)		x	x	
19		Chromium and compounds (as Cr)		x	x	
20		Copper and compounds (as Cu)	x		x	
21		Mercury and compounds (as Hg)	x		x	
22		Nickel and compounds (as Ni)	x		x	
23		Lead and compounds (as Pb)	x		x	
24		Zinc and compounds (as Zn)	x		x	
25	15972-60-8	Alachlor	x		x	
26	309-00-2	Aldrin	x		x	
27	1912-24-9	Atrazine	x		x	
28	57-74-9	Chlordane				Chlordane-removed as it is banned for use
29	143-50-0	Chlordecone				Chlordecone-removed as it is banned for use
30	470-90-6	Chlorfenvinphos	x		x	
31	85535-84-8	Chloro-alkanes, C10-C13	x		x	
32	2921-88-2	Chlorpyrifos	x		x	
33	50-29-3	DDT	x		x	
34	107-06-2	1,2-dichloroethane (EDC)	x		x	
35	75-09-2	Dichloromethane (DCM)	x		x	
36	60-57-1	Dieldrin	x		x	
37	330-54-1	Diuron	x		x	
38	115-29-7	Endosulphan	x		x	

PRTR	CAS No.	Substance	Priority Substance	Relevant Pollutant	EQS Proposed	Comment
39	72-20-8	Endrin	x		x	
40		Halogenated organic compounds(as AOX)				Halogenated Organic Compounds - is on the list in individual forms
41	76-44-8	Heptachlor				Heptachlor- removed as it is banned for use
42	118-74-1	Hexachlorobenzene (HCB)	x		x	
43	87-68-3	Hexachlorobutadiene (HCBD	x		x	
44	608-73-1	1,2,3,4,5,6-hexachlorocyclohexane(HCH)	x		x	
45	58-89-9	Lindane	x		x	
46	2385-85-5	Mirex				Mirex- removed as it is banned for use
47		PCDD + PCDF (dioxins + furans) as Teq		x		
48	608-93-5	Pentachlorobenzene	x		x	
49	87-86-5	Pentachlorophenol (PCP)	x		x	
50	1336-36-3	Polychlorinated biphenyls (PCBs)		x		
51	122-34-9	Simazine	x		x	
52	127-18-4	Tetrachloroethylene (PER)	x		x	
53	56-23-5	Tetrachloromethane (TCM)	x		x	
54	12002-48-1	Trichlorobenzenes (TCBs) all isomers	x		x	
55	71-55-6	1,1,1-trichloroethane		x		
56	79-34-5	1,1,2,2-tetrachloroethane		x		
57	79-01-6	Trichloroethylene	x		x	
58	67-66-3	Trichloromethane	x		x	
59	8001-35-2	Toxaphene				toxaphene- removed as it is banned for use
60	75-01-4	Vinyl chloride		x		
61	120-12-7	Anthracene	x		x	
62	71-43-2	Benzene	x		x	
63		Brominated diphenylethers (PBDE)	x		x	
64		Nonylphenol and Nonylphenol ethoxylates (NP/NPEs)	x		x	
65	100-41-4	Ethyl benzene		x		
66	75-21-8	Ethylene oxide				
67	34123-59-6	Isoproturon	x		x	
68	91-20-3	Naphthalene	x		x	
69		Organotin compounds(as total as Sn)		x		
70	117-81-7	Di-(2-ethyl hexyl) phthalate (DEHP)	x		x	

PRTR	CAS No.	Substance	Priority Substance	Relevant Pollutant	EQS Proposed	Comment
71	108-95-2	Phenols (as total C)		x	x	
72		Polycyclic aromatic hydrocarbon (PAH)	x		x	
73	108-88-3	Toluene		x	x	
74		Tributyltin and compounds	x		x	
75		Triphenyltin and compounds		x	x	
76		Total organic carbon (TOC)				General Component
77	1582-09-8	Trifluralin	x		x	
78	1330-20-7	Xylenes		x	x	
79		Chlorides (as total Cl)		x		
80		Chlorine and inorganic compounds				Air
81	1332-21-4	Asbestos				
82		Cyanides (as total CN)		x	x	
83		Fluorides (as total F		x	x	
84		Fluorine and inorganic compounds				Air
85	74-90-8	Hydrogen cyanide (HCN				Air
86		Particulate matter (PM10)				Air
87	1806-26-4	Octylphenols and Octylphenol ethoxylates	x		x	
88	206-44-0	Fluoranthene	x		x	
89	465-73-6	Isodrin	x		x	
90	36355-1-8	Hexabromobipheny				
91	191-24-2	Benzo(g,h,i)perylene	x		x	