European Commission (DG Environment)

Technical Support for the Impact Assessment of the Review of Priority Substances under Directive 2000/60/EC

Substance assessment: DEHP

June 2011

Entec UK Limited

European Commission (DG Environment)

Technical Support for the Impact Assessment of the Review of Priority Substances under Directive 2000/60/EC

Substance assessment: DEHP

June 2011

Entec UK Limited

Report for

European Commission
Unit D.1 Water
Avenue de Beaulieu 9, Office 03/140
B-1160 Brussels
Environment Directorate-General
BELGIUM

Main Contributors

Heather Musgrave
Liz Duffy
Simon Clarke

Issued by

....
Heather Musgrave

Approved by

....
Martin Houldin

Entec UK Limited

17 Angel Gate
City Road
London EC1V 2SH
England
Tel: +44 (0) 207 843 1400
Fax: +44 (0) 207 843 1410

Doc Reg No. 26135C29

r:\projects\26135 ppw wfd hazardous substances ia support\c client\reports\final\issue 4\substances\26135c29i5 dehp 210611.doc

Document Revisions

No.	Details	Date
1	Draft issued for comment	Jan 2011
2	Re-issued with amendment to cross referencing	Jan 2011
3	Revised with comments from WGE addressed	Feb 2011
4	Revised with further stakeholder comments	Apr 2011
5	Final Report	June 2011

Contents

1. Introduction

1.1 Purpose of the report

The purpose of this report is to assess the potential costs and benefits associated with the proposed change in status of DEHP (di(2ethylhexyl)phthalate) under the Water Framework Directive (2000/60/EC). The report will be used to support the European Commission's Impact Assessment of the review of Priority Substances.

The report can be read as a stand-alone report, but should ultimately be read in conjunction with the overarching project report (to be produced in early 2011), which will include a combined assessment of all substances proposed to be included or amended.

1.2 Substance summary

DEHP is entirely man-made and is not naturally present in the environment. Its main use is as a plasticiser in plastics such as PVC, where it is used in order to make the material soft and flexible. DEHP may be released from processes manufacturing PVC products, and when it is combined with plastics. Although the majority of the DEHP is intended to remain in the plastic products throughout their useful life, some DEHP can be released from the plastic and hence enter the environment. As such, some DEHP may be released to the water environment, especially if the plastic is in contact with water, either directly, by washing or from rain water. As plastics that contain DEHP are used for a large number of different applications, the sources of DEHP emissions to the environment could be varied. DEHP is toxic to humans as it may have harmful effects on reproduction and cause harm to unborn children[1].

There are already various controls on DEHP including:

- Regulation 1272/2008 on the Classification, labelling and packaging of substances and mixtures. DEHP is classed as toxic to reproduction, Category 2.
- REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) Regulation 1907/2006 (EC) includes restrictions on marketing and use of DEHP:
  - Candidate list for as a Substance of Very High Concern (SVHC) and inclusion on Annex XIV. This would mean that DEHP would require Authorisation;
  - Qualifies under entry 30 of Annex XVII: substances classed as toxic to reproduction (category 1 or 2);
  - Entry 51 of Annex XVII: DEHP, DBP and BBP. Shall not be used in toys and childcare articles and concentrations higher than 0.1% by mass of plasticized material.

[1] Based on classification under Annex I of Directive 67/548/EEC

- IPCC (Integration Pollution Prevention and Control) Directive 2008/1/EC This legislation includes measures related to accidental spills, production of DEHP and PVC, waste treatment and management.

The measures are discussed further in Section 3. It should be noted that if DEHP is included in Annex XIV of REACH, the product will required Authorisation. Depending on whether authorisation is granted, use of DEHP may be significantly reduced or cease. However currently it is on the candidate list rather than on the Annex.

1.3 Why is it is a problem and why is EU-wide action suggested?

DEHP is currently a priority substance under the Water Framework Directive. This means that DEHP is already being monitored by Member States and where necessary action should already be taken to meet the current standards. The results of the European Risk Assessment Report (EU-RAR) and inclusion of DEHP as a substance of very high concern (SVHC)) have given cause for consideration about whether the current standards and requirements regarding DEHP under the Water Framework Directive are sufficient. For example, representatives of the Working Group E were invited to comment on the status of existing substances in a questionnaire issued in March 2010. The responses that were received in relation to DEHP are summarised in Table 1.1, including responses from two MS regarding the reprotoxicity. These reasons have been challenged by the industry body ECPI.

Table 1.1 Responses from MS on status of existing substances (for DEHP only)

Member State	Justification
Norway	Believe substance should be reclassified for the following reasons: DEHP was included as substance of very high concern (SVHC) in the candidate list for authorisation due to toxicity for reproduction, see ECHA website We have found this substance in remote areas in south of Norway (sediment and biota). Link: http://www.klif.no/publikasjoner/2284/ta2284.pdf page 63. This substance is also on REACH substance list.
Sweden	Believe substance should be reclassified for the following reasons: Reprotoxic. The risk assessment suggests risk for secondary poisoning.

Note in relation to the final report: Since the time of production of the first and second draft reports, DEHP has been included in Annex XIV of REACH. The sections of this final report that discuss the regulation of DEHP have not been altered due to the late stage in the process. However the final report should be read with this recent change to regulation in mind. Since DEHP has been included in Annex XIV, industry must now apply for authorisation for any ongoing use, with a sunset date of February 2015, and deadline for authorisation applications of August 2013.

1.4 What is being proposed?

DEHP is currently a priority substance under the Water Framework Directive. An Environmental Quality Standard (EQS) has been set of 1.3 µg/l.

It has been proposed that the status of DEHP should be changed from a Priority Substance to a Priority Hazardous Substance. If this proposal were to be progressed, phasing out of all emissions of DEHP would be required within 20 years. The reason for the proposal is, as discussed above, the availability of information suggesting that DEHP is reprotoxic, and its classification as a Substance of Very High Concern.

No changes are proposed to the existing EQS.

1.5 Approach to this assessment

The methodology for undertaking this impact assessment has been defined in the first interim report for the project (Entec, 2010). The assessment overall must cover each substance being considered for inclusion or amendment in the directive by the Commission, and must provide an EU-level assessment. A case study-based approach is being taken, to allow best use to be made of the available data. For each substance one or more case studies will be undertaken at a Member State level. The results of these case studies will be used to consider the likely impacts at the EU level as a whole.

For DEHP, three case studies have been selected. The criteria for identifying the case studies can be found in more detail in Entec, 2010. The most important criteria in selecting the case studies was to ensure that for each substance, all relevant sectors were covered, and that at least one Member State is selected that is likely to need to take action on the substance.

The case studies that have been selected for DEHP are:

- Netherlands - has been selected because their questionnaire responses indicate failures of EQS. In addition they provided information and discussion regarding measures in the questionnaire responses, which will be informative to the assessment. Finally, their emissions data in E-PRTR will help to inform the baseline;
- Germany - has been selected for a case study as a number of production sites in Germany are reported in the EU-RAR- this is important to ensure sector coverage.
- Hungary - has been selected because it reports failures of the substance in the questionnaire responses, and this will help to improve spatial coverage of the IA overall.

However it should be noted that limited information has been received specifically in relation to the case studies so far. The assessment therefore is predominantly a high-level consideration of the EU as a whole.

As DEHP is an existing priority substance, the focus of this report will be on understanding the measures that have already been put in place in relation to its current status, and whether these will be sufficient to meet the requirements of the proposed change in status.

1.6 Consultation

Table 1.2 shows a record of the consultation carried out with Member States, industry associations and other stakeholders regarding DEHP.

Table 1.2 Consultation Log

Member State	Date initial contact made	Response/ Notes
All Member States	March 2010	Questionnaire requesting information on existing substances, including percentage failures per MS.
CEFIC	15/09/10	Information requesting further information on measures costs and benefits of controlling industrial substances (including DEHP). No responses received in relation to this substance specifically.
Netherlands	24/11/10	Contacted Netherlands to request further information on a number of substances, including DEHP (beyond that provided in questionnaire). No information received to date.
Germany	23/11/10	Contacted Germany to request further information on a number of substances, including DEHP (beyond that provided in questionnaire). No information received to date.
Hungary	19/11/10 to 10/12/10	Contacted Hungary to discuss potential for obtaining further information about DEHP and measures in Hungary (beyond that provided in questionnaire). No information received to date.
Latvia	26/01/11	Comments provided on draft report
Greenpeace	14/01/11	Comments provided on draft report
ECPI	31/01/11, 10/02/11	Comments provided on draft report, as well as statements relating to the justification for the proposal to classify as PHS
EUREAU	11/02/11	Comments provided on draft report

1.7 Structure of this report

The structure of the report is set out to work through the steps of the impact assessment, as recommended in the Commission's Impact Assessment guidelines (EC, 2009). The report therefore includes:

- Section 2 sets out the baseline for the study. This is the consideration of the current situation and the future situation with the application of current and foreseen or agreed measures (i.e. legislation and policy that controls the marketing, use and environmental emissions of the substance): this is often referred to as the business as usual (BAU) scenario. This includes the current status of DEHP as a Priority Substance;

- Section 3 identifies the possible range of impacts that result from the use of DEHP and additional measures may be put in place in relation to the proposal to classify the substance as a Priority Hazardous Substance;
- Sections 4 and 5 assess the impacts in terms of costs and benefits respectively. Within these sections the focus is on who is affected by the impacts (i.e. who pays the costs and who gets the benefits);
- Section 6 summarises and concludes the assessment, focussing on the costs and benefits at the EU level.

The report has been arranged to present the results at the EU level. Additional detail and focus is provided in relevant sections by focussing in on the Member State case studies, i.e. in the baseline section and the costs and benefits sections, where information is available. The case studies are used as illustrations of the situation at the wider EU level, supported by other EU level data where it is available.

2. The Baseline Situation

2.1 Current production and uses

2.1.1 Production

Di(2-ethylhexyl)-phthalate (DEHP) is a substance that acts as a plasticiser in a variety of polymer products. It is produced by the esterification of phthalic anhydride with 2-ethyl-hexanol. It is produced in a closed system which can be run continuously or as a batch process (ECPI 2010).

In 1997, the production of DEHP in Western Europe[2] was 595,000t and the consumption of DEHP in Europe was estimated at 476,000t, export at 186,000t and import around 67,000t, as reported in the EU risk assessment (KEMI, 2008). By 2007, production had reduced to 341,000t in the EU as a whole (COWI 2009). The market for DEHP has been decreasing in the last 10 years as it has been substituted for alternative compounds in a number of applications, although industry has suggested that the level of use has stabilised in the last few years (Entec, 2008). In 2007 DEHP accounted for 18% of the total European market of plasticisers (COWI, 2009).

The European Chemical Substances Information System (ESIS[3]) contains information on producers and/or importers of DEHP, which is listed as a High Production Volume (HPV) chemical. The number of producer/importers identified by ESIS is 32, but it is believed there are considerably less than that now. More reliable information can be obtained from the EU-RAR (Kemi, 2008), which lists 18 producers in 10 Member States, although it is known that at least five of those sites have also ceased production. COWI (2009) list only seven manufacturing sites, for of which were identified in the EU-RAR, with additional three in new Member States. Therefore there is some uncertainty about the companies still producing DEHP and the number of sites.

Table 2.1 Producers of DEHP (from KemI, 2008 and COWI, 2009)

Member state	Manufacturers listed in EU-RAR (KemI, 2008)	Manufacturers listed in COWI (2009)
Italy	Industrie Generali SpA, Lonza 3, Lonza5 Enichem SpA (now ceased), SISAS (now ceased)	Polynt Spa
France	Elf Atochem Fr	Arkema
Germany	BASF AG, BSL (now ceased), Celanese 1,	OXEA GmbH

2 The spatial extent of Western Europe is not defined in the draft EU risk assessment report.

3 http://ecb.jrc.ec.europa.eu/esis/

	Oxeno Olefinchemie2	
Spain	BASF spañola, Plastificantes de Lutxana (PDL	
UK	BP Chemicals (now ceased according to Entec, 2008)	
Austria	OMV Chemie Linz (ceased 1993)	
Sweden	Neste Oxo	Perstorp AB
Finland	Neste Oy	
Belgium	SISAS Pantochim, SISAS4	
Portugal	Driftal GPD	
Czech Republic		Deza A.S.
Romania		Oltchim S.A.
Poland		Zaklady Azotowe Kędzierzyn SA

2.1.2 Use

DEHP is widely used as a plasticiser in polymer products, mainly polyvinyl chloride (PVC). Plasticisers have the function of improving the polymer material's flexibility and malleability. It is also used in a number of non-polymer applications, such as paints and lacquers.

It is estimated that approximately 97% of DEHP historically has been used as a plasticiser in polymers, with 2-3% used in non-polymer products (KEMI, 2008). However the proportions of use may change as a result of existing and expected legislation (REACH. See Section 3).

DEHP in polymers

When DEHP is used as a plasticiser, its content in flexible polymer materials varies but is often around 30 % (w/w). DEHP is mixed with the polymer and this is followed by processing of the material. Although the EU-RAR (KEMI, 2008) states that both phases (i.e. mixing and processing) often occur on the same site, a number of medium-sized flexible PVC producers only process the material. It is estimated that around 800 companies in Europe are involved in the processing of flexible PVC, many of them of small to medium sized firms (Entec, 2008).

The use of flexible polymers, mainly PVC, is widespread across a number of different sectors, with 78% used in indoor (e.g. flooring, upholstery) and 22% in outdoor (e.g. roofing material, tubing, shoes and waterproof clothing) applications. Examples of end uses are presented in Table 2.2.

DEHP in non-polymer products

Non-polymer products represent a minor use of DEHP compared to the use in polymers. It can be used as an additive in rubbers, latex, mastics and sealants, lubricants, inks and pigments. Some examples of non-polymer end products (as well as polymer uses) are set out in Table 2.2.

Table 2.2 Example of end-uses of products containing DEHP* (based on KEMI, 2008)

Use	Quantity	Indoor/Outdoor	Examples of end-use
Polymer (mainly PVC)	97%	78% indoor	Sheets, film, wall- and roof covering
			Flooring
			Coatings and leather imitations (car seats, home furniture)
			Pastes for sealing and isolation
			Medical products (predominantly DEHP usage)
			(previously in toys and child-care articles but no longer permitted)
		22% outdoor	Roofing material
			Roofing (coil coating)
			Cables
			Coated fabric
			Hoses & Profiles
			Car under-coating
			Shoe soles
Non polymer	3%		Lacquers and paints
			Adhesives
			Fillers
			Printing inks
			Dielectric fluids in capacitors
			Ceramics

* Products containing DEHP are no longer produced for some of these purposes, but they may still be in use. For example, according to industry stakeholders, DEHP is no longer used in the formulation of printing inks or adhesives.

2.2 Current emissions

2.2.1 Sources and pathways to water

Summary of sources of emissions

Given the production and uses of DEHP discussed above, emissions of DEHP could potentially occur to the water and the wider environment. In terms of its use in polymers, DEHP is not chemically bound to the polymer matrix and can potentially migrate from the polymer and hence enter the environment.

The main sources of emissions are likely to include (based on source screening sheets):

- Releases from materials and constructions in non sewered areas;
- Discharges in sewage effluents or storm water as a result of run off from buildings, paving and constructions;

- Discharges in sewage effluents or storm water as a result of households and consumer use of PVC with DEHP as a plasticizer. For example from households, losses could occur from plastic household pipes or washing/abrasion of polymer floors or shower curtains;
- Discharges in sewage effluents or emissions directly to water due to industrial activities, IPPC and non-IPPC (including DEHP production, industrial use of PVC and production/formulation of PVC);
- Emissions to air from buildings, household/consumer use and production. This can ultimately result in atmospheric deposition on the water surface;
- Releases from landfill or other waste (to water or air). KemI (2008) also identify the potential for end-of life activities such as paper recycling and car shredding to contribute to releases of DEHP (Entec, 2008).

Releases from some of these sources may decrease over time, since the use of DEHP in some new products has diminished or ceased (i.e. as existing products reach the end of their life and are replaced with alternatives that do not contain DEHP).

DEHP is not generally released intentionally because its function is fulfilled by remaining in the polymer matrix in order to impart its plasticising effect. Its releases may arise from production, intermediate processes, or due to leaching from the polymer matrix.

Mechanisms of emissions to water

The sources of DEHP in the water environment comprise both point sources and diffuse sources. The most frequent/ significant point source is expected to be the discharge of effluents from sewage treatment works. DEHP in domestic wastewater can originate from the release of the substance, through uses of its various products and materials, by slow diffusion of the surface of the product/material during washing/cleaning operations or in wet weather (from outdoor domestic uses and surface run-off intercepted by combined sewers) or continuously if in direct contact with water (e.g. from pipes, cables and tubes), recognising that in some circumstances DEHP may be biodegraded at the surface of these articles. Other contributors of DEHP to wastewater are industrial sources, such as those producing or utilising products based on flexible PVC, where industrial sites discharge effluent to the public wastewater system.

DEHP has also been detected in variable concentrations in diffuse sources. It occurs in urban surface run-off, which is discharged to the water environment either separately or mixed with sewage (in combined sewers). Sources of DEHP in the urban environment may include vehicles (from DEHP used in undersealants), outdoor PVC uses, plastic pipes/hoses, shoes and waterproof clothing. DEHP in run-off may also originate from releases from building materials, roofs, flooring, cables, and also in part from the diffuse atmospheric deposition of volatilised DEHP (from a variety of PVC products and materials and industrial emitters). DEHP in runoff from housing estates has been measured in studies including UKWIR, 2004.

2.2.2 E-PRTR emissions

Emissions by activity

Point-source emissions of DEHP to air and water are reported by Member States to the E-PRTR database[4]. Data are available for 2007 and 2008. In total 117 facilities reported emissions in 2007, and 214 facilities in 2008. The quantities of emissions reported from different types of sources are shown in Table 2.3.

Table 2.3 Summary of emissions from E-PRTR for DEHP

Activity	Emissions to air		Emissions to water	
	2007	2008	2007	2008
Energy sector (thermal power stations and other combustion installations)	-	16.9kg	4.64kg	56.3kg
Production and processing of metals (production of pig iron or steel and non-ferrous crude metals; ferrous metal foundries)	-	-	22.6kg	38.6kg
Mineral industry (opencast mining and quarrying, production of cement clinker or lime, manufacture of glass)	2.48t	4.29t	2.04kg	-
Chemical industry (production of basic organic and inorganic chemicals, and pharmaceuticals)	14.7t	9.77t	699kg	143kg
Waste and wastewater management (UWWTPs and landfills)	-	-	4.07t (3.89t from UWWTP)	21.9t (21.6t from UWWTP)
Paper and wood production processing	-	-	114kg	47.1kg
Other activities (treatment of textiles)	1.29t	2.02t	1.29t	9.26kg

The vast majority of DEHP emissions to water in both 2007 and 2008 in the EU were from urban waste-water treatment plants. Over 21 tonnes were reported to have been emitted from UWWTPs in 2008, making up 97.4% of the total emissions to water that year. This was an increase from the emissions in 2007, where the emissions from urban waste-water treatment plans were around 4 tonnes (79.1%). The emissions from UWWTP were considerably higher than those directly from the chemical industry. This could indicate that the majority of DEHP in water may be from the use phase rather than production, although it is also possible that industrial sites discharge effluent directly to the public wastewater system, meaning that industrial wastewater then has to be treated in the public UWWTP (see section below regarding pollutant transfers).

[4] http://prtr.ec.europa.eu/PollutantReleases.aspx

The emissions to air show a rather different picture, with the majority of emissions in this case relating to production rather than use. The majority of emissions of DEHP from the chemicals industry are to air, with over 14 tonnes released in 2007 and nearly 10 tonnes in 2008. In addition to this, tonnes of DEHP are reported to be released to air from the mineral industry, specifically from the production of cement clinker. Further clarification is required as to the source of DEHP in this case.

For both emissions to air and water, there are also some small emissions reported from the energy sector and metals production. Again, the reason for these emissions is not known, although it could possibly be related to the use of cooling water already containing DEHP, or at energy-from-waste sites where waste containing DEHP is burnt.

E-PRTR transfers

In order to consider further the extent to which industrial emissions may contribute to releases of DEHP from UWWTP, the E-PRTR 'pollutant transfer' register has been used. The data in the register for DEHP are shown in Table 2.4. This shows that there are a number of facilities that have reported releasing DEHP in to the sewerage system for treatment at downstream UWWTPs, although when compared to the quantity of DEHP released from UWWTPs (Table 2.3), the total of the pollutant transfers represents only a small proportion. This suggests that the DEHP in sewage effluent is from a combination of diffuse and point sources. More years of data, as reporting to E-PRTR improves further, may help to refine the distinction between the two types of sources.

Table 2.4 Pollutant transfers reported in E-PRTR

Industry	2007	2008
Energy sector (coke ovens)	1 facility, 2.95 kg	1 facility, 2.66 kg
Surface treatment of metals and plastics using electrolytic or chemical processes	1 facility, 13.0 kg	-
Industrial scale production of basic organic chemicals	1 facility, 47.2 kg	1 facility, 2.53 kg
Landfills	2 facilities, 2.44 kg	1 facility, 1.07 kg
Independently operated industrial wastewater treatment plants	-	1 facility, 3.48 kg
Production of pulp from timber or similar fibrous materials	1 facility, 46.4 kg	1 facility, 30.2 kg
Pre-treatment or dyeing of fibres or textiles	1 facility, 4.16 kg	-
Surface treatment of substances, objects or products using organic solvents	2 facilities, 2.58 kg	1 facility, 1.15 kg

Emissions by Member State

The emissions reported to E-PRTR are shown in Table 2.5 by Member State.

Table 2.5 E-PRTR emissions by Member State

Member State	Emissions to air		Emissions to water	
	2007	2008	2007	2008
Austria	-	-	162kg	83.4kg
Belgium	2.74t	2.70t	-	996kg
Czech Republic	63kg	61kg	120kg	122kg
Denmark	-	-	8.41kg	913kg
Finland	-	-	113kg	190kg
France	-	-	1.03t	13.1t
Germany	1.48t	1.40t	156kg	323kg
Hungary	9.75t	5.46t	-	-
Ireland	-	-	274kg	291kg
Italy	-	-	-	179kg
Latvia	1.53t	-	-	-
Netherlands	-	-	15.3kg	1.27t
Poland	1.79t	4.07t	135kg	10.5kg
Portugal	-	-	3.15kg	1.08t
Romania	-	-	11.9kg	
Slovakia	-	-	661kg	37.2kg
Slovenia		-	18.4kg	47kg
Spain	62.4kg	1.35t	1.28t	1.74t
Sweden	725kg	725kg	399kg	579kg
UK	311kg	311kg	42.8kg	977kg

Overall, the amount of DEHP releases to water in the EU increased from approximately 4.9 tonnes in 2007 to 22 tonnes in 2008. Part of the reason for this overall increase was the increase in releases from France where in 2008 over 13 tonnes (making up 59% of the total releases that year) was released compared to 284 kg in 2007 (21%). Spain also has a high volume of releases, with 1,743 kg released in 2008 (8%) and 1,284 kg (26%) released in 2007.

For the case study Member States:

- Netherlands reported the release of 1,270 kg of DEHP to water (6% of total reported releases in the EU) in 2008. This was an increase on 2007 where only 15 kg were reported to be released (less than 1% of the total reported releases). All of these emissions are from sewage treatment works, with a particularly high emission of 1.16t from a single location in 2008 (AWZI Leiden Zuidwest), whereas all other emissions in NL from STWs were less than 10kg. The reason for the high emission has not been established in this assessment.

- The total releases reported by Germany also increased from 156 kg in 2007 to 323 kg in 2008 (making up 1% and 3% of the total releases reported). These emissions were predominantly from sewage treatment works, with one emission from a chemicals (DEHP) production site.
- In Hungary, there were no recorded releases of DEHP to water in 2008 or 2007.

In terms of emissions to air, for the case study Member States:

- Hungary's reported releases to air decreased from 9.8t in 2007 to 5.5t in 2008. In both cases these releases were from one facility, Graboplast Zrt. This is a manufacturer of basic plastic materials. However, it is still the country with the greatest volume of reported releases, making up 53% of total releases in 2007 and 34% in 2007. (Poland and Belgium are the countries with the next greatest volume of DEHP releases reported to air, making up 25% and 17% of total reported releases in 2008 respectively.)
- Germany's reported releases have stayed similar, with 1400kg reported to be released in 2008 (9%) and 1480kg in 2007 (8%). Both of these reported releases were from one facility, Oxea Deutschland GmbH Werk Ruhrchemie, which manufactures basic chemicals and plastic materials. This corresponds to one of the production sites listed in COWI (2009).
- There were no reported DEHP releases to air from Netherlands in either 2008 or 2007.

2.2.3 Calculated emissions (EU-RAR)

Emissions from each phase of the life-cycle of DEHP were calculated in the EU-RAR (KemI, 2008). A summary is provided in Table 2.5, replicated from the EU-RAR. The information is provided as percentages, to allow the proportional significance of different sources to be understood.

Overall, the calculations from the EU-RAR indicate that the 'end-of-life' phase is the greatest proportion of contribution of DEHP to the environment, with the majority of this being to soil. Some of this contribution to soil has the potential over time to make its way into groundwater and potentially to surface water, depending on how the waste is managed. Emissions to air may also contribute to surface water over time, although the EU-RAR suggests that emissions to air are relatively minor in comparison to other environmental compartments.

The calculated emissions to wastewater in Table 2.6 may be considered to be the most relevant in terms of gaining an overall understanding of emissions of DEHP to surface water. This suggests that:

- Around 18% of emissions are from the production and industrial use phases;
- Around 41% of emissions are from the end-product use phase, including both indoor and outdoor uses;

- Around 40% of emissions are from the end-of-life phase. Little of this is from managed waste, with the majority being from waste ‘remaining in the environment’. The EU-RAR describes this as “particles/fragments abraded from end-use products during their service life and during disposal (e.g. particles abraded from car undercoating, coil coating, shoe soles and fragments of plastic bags etc.)”. Some might interpret this to be from the use phase rather than end-of-life.

There is some blurring between the ‘use’ and ‘end of life’ phases in the EU-RAR assessment. The most important consideration, however, may be the distinction between the production and use phases. The EU-RAR assessment of emissions indicates that industrial emissions such as those reported in the E-PRTR will represent less than a quarter of the total emissions of DEHP to water. As a result it is important to consider the use and waste phases when considering approaches to reducing or ceasing emissions.

Table 2.6 Summary of distribution in tonnes of DEHP emissions to different environmental compartments during the total life cycle (EU, expressed as % of total) (from EU-RAR, 2008)

Life-cycle stages	Emissions to air	Wastewater	Urban soil 0-5cm	Urban soil >5cm	Total per year
1a production	0.01	**2.4**	0.03	0	2.4
1b transportation	0	**0.2**	0	0	0.2
Polymers					
2a-g polymer-proc/form	0.7	**0.7**	0	0	1.4
Non-polymers:					
3a Sealant formulation	0.1	**0.4**	0.004	0	0.5
3b Sealant processing	0.004	**0**	0.2	0	0.2
4a Paint formulation	0.01	**0.05**	0.0005	0	0.06
4b Paint processing	0	**0.005**	0.03	0	0.03
5a Ink formulation	0.014	**0.06**	0.0006	0	0.07
5b Ink processing	0.014	**0.06**	0.0006	0	0.07
6 Ceramic formulation	0.0003	**0.002**	0.00001	0	0.002
Total: industrial uses	1.1	**3.7**	0.3	0	5.1
7 Polymer-indoor use	0.6	**4.6**	0	0	5
7 Polymer-	0.02	**2.4**	2.3	20	25

outdoor use					
7 Non-pol indoor use	0.06	**1.1**	0	0	1.2
7 Non-pol outdoor use	0.005	**0.6**	0.6	0	1.1
Total: end-product uses	0.7	**8.6**	2.8	20	32
8a paper recycling	0	**0.3**	0	0	0.03
8b car shredder	0.02	**0**	0.2	0	0.2
8c Incineration stations	0.02	**0**	0	0	0.02
8d Municipal landfill	0	**0.05**	0	0	0.05
8e Waste/ environment	0.03	**8.5**	26	29	63
Total: disposal	0.07	**8.5**	25	29	63
Total	1.9	**21**	28	49	100

2.3 Environmental Concentrations

As DEHP is an existing priority substance, Member States have a responsibility to monitor its concentrations in the aquatic environment. Information was requested from Member States in the questionnaire on existing substances issued in March 2010, to establish the extent to which they consider they experience failures of the current EQS. The Member States that responded to the questionnaire are listed in Table 2.7. As can be seen, not all Member States responded to the question on DEHP. There was no consistency in the responses as to whether a blank represented 'zero' or 'no data', which makes it more difficult to establish the extent of compliance with the EQS. Four Member States indicate some failures of the EQS, with both France and Slovakia reporting a high percentage of failures. Only two Member States definitively stated that they had no failures (Austria and Slovenia). It is difficult therefore to confirm the extent of failure of the EQS across the EU as a whole, but it is clear that at least some failures occur currently. The apparent extent of variation in the percentage failure between Member States is somewhat surprising given the widespread use of products containing DEHP. It is possible that some Member States have not monitored for DEHP widely (this seems to be the case given the questionnaire responses), and the percentage failure would need to be linked to a number of waterbodies for more certainty in data interpretation. Further investigation would be required to establish whether the failures could be linked to known locations of emissions.

Table 2.7 EQS failures in Member States

Member State	% EQS failures for rivers	% EQS failures for lakes	% EQS failures for transitional waters	% EQS failures for coastal waters
Austria	0	0	n/a	n/a
Belgium	No data?	No data?	No data?	No data?
Cyprus	0?	0?	0?	0?
Czech Republic	0?	0?	0?	0?
Germany	Not provided	Not provided	Not provided	Not provided
Denmark	Not provided	Not provided	Not provided	Not provided
Estonia	No data?	No data?	No data?	No data?
Spain	No data?	No data?	No data?	No data?
France	4.97	23.53	6.35	2.86
Hungary	1.9	No data?	n/a	n/a
Italy	0?	0?	0?	0?
Lithuania	No data?	No data?	No data?	No data?
Latvia	No data?	No data?	No data?	No data?
NL	0	0.67	0	0
Poland	Not provided	Not provided	Not provided	Not provided
Portugal	0?	0?	0?	0?
Romania	0?	0?	0?	0?
Slovenia	0	0	n/a?	0
Slovakia	18.8	0	n/a	n/a
Sweden	0?	0?	0?	0?

Where blanks were left by MS in their questionnaire responses, the blanks have been interpreted (i.e. as being a 'zero' or a 'no data' response) depending on the way in which the rest of the questionnaire had been completed by each MS. These have been identified with '?' i.e. if a MS presented data for a large number of substances but there were no zeros, any blanks were taken to represent zeros. Alternatively if zeros were recorded for other substances, any blanks were assumed to mean 'no data'

3. Identifying the impacts

3.1 Identification of measures

3.1.1 Assessment of possible measures

Existing measures

DEHP is already included as a Priority Substance in the Water Framework Directive (2000/60/EC), with an EQS defined within the Environmental Quality Standards Directive (2008/105/EC). This places requirements on Member States to control the levels of DEHP in the aquatic environment. A number of other EU-level measures also exist that influence the production, use and/or disposal of DEHP, including:

- Regulation 1272/2008 on the Classification, labelling and packaging of substances and mixtures (amends and repeals Directives 67/548/EEC and 1999/45/EC, and amends Regulation 1907/2006). DEHP is classed as toxic to reproduction, Category 2.
- Commission Recommendation 2008/98/EC on risk reduction measures for a number of substances. The recommendation for DEHP is based on the risk evaluation and risk reduction strategies and gives the following risk reduction measures for the environment: "*For the river basins where emissions of DEHP may cause a risk, the relevant Member State(s) establish EQSs and the national pollution reduction measures to achieve those EQS in 2015 shall be included in the river basin management plans in line with the provisions of Council and Parliament Directive 2000/60/EC (Water Framework Directive)*".
- REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) Regulation 1907/2006 (EC) includes restrictions on marketing and use of DEHP:
  - Candidate list for as a Substance of Very High Concern (SVHC) and inclusion on Annex XIV. This would mean that DEHP would require Authorisation;
  - Qualifies under entry 30 of Annex XVII: substances classed as toxic to reproduction (category 1 or 2);
  - Entry 51 of Annex XVII: DEHP, DBP and BBP. Shall not be used in toys and childcare articles in concentrations higher than 0.1% by mass of plasticized material.
- IPCC (Integration Pollution Prevention and Control) Directive 2008/1/EC consolidates requirements for industrial emissions into a single clear and coherent legislative instrument. This legislation includes measures related to accidental spills, production of DEHP and PVC, waste treatment and management.
- Relating to emissions from waste, there are a number of existing measures, including Directive 1999/31/EC on the landfill of waste, Directive 2008/98/EC on

waste. Directive 2000/76/EC on the incineration of waste and Directive 1999/31/EC on the landfill of waste do not contain specific provisions with regard to DEHP discharges and emissions.

In the questionnaire issued to Working Group E in March 2010, members were invited to provide information on measures they are undertaking at a national level, in addition to the EU level measures discussed above, to contribute towards meeting the WFD requirements. For DEHP, only three Member States responded to this question, as shown in Table 3.1. There appear to be few MS-specific measures being put in place to control concentrations of DEHP in water currently.

Table 3.1 Responses by Member States regarding additional national or local measures being undertaken to address DEHP (questionnaire March 2010)

Member State	Information provided
Belgium (F)	"No measurements are available for the moment. Further investigation is needed"… Measures possibly needed
Germany	"On a national scale the focus is more on secondary measures like improved storm water handling, erosion prevention, justified improved waste water treatment beyond the general level of BAT. These measures and their combinations are tailor made to the specific regional circumstances. Additionally 'soft' measures like specific information campaigns for customers or farmers are already partly implemented or planned."
Sweden	Continuous work regarding permit procedures and supervision.

There are also proposals for further legislation that could affect DEHP. These could include (as listed in the measures sheet produced for DEHP):

- Proposal for a directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (COM(2008)809) - i.e. potential ban on use of DEHP in electrical equipment through a recast of Directive 2002/95/EC;
- Consideration of banning DEHP as a plasticizer in PVC (impact assessment published April 2010).

These potential measures, in addition to the potential for DEHP being placed on Annex XIV of REACH, could significantly affect the use of DEHP in the EU to the extent that the scope of the impact assessment would be considerably reduced. However, as none of these 'potential' measures have yet been agreed, the impact assessment does not include them in the baseline.

Working Group identification of need for further measures

In the questionnaire issued to Working Group E in March 2010, members were invited to indicate whether they expected further EU-level measures to be necessary in order to control concentrations of DEHP in water. Four Member States responded to this question, as shown in Table 3.2. The potential influence of REACH is recognised by Member States, which may affect whether further measures are required. However, notably, France considers that addressing point-source discharges will not be sufficient to control concentrations of DEHP due to ‘complex diffuse pollution’. This will be considered further below.

Table 3.2 Need for possible further measures identified by MS (questionnaire March 2010)

Member State	Response
Belgium (F)	“No measurements are available for the moment. Further investigation is needed. In the future it is possible that EU-measures are needed.”
Germany	“Improved Harmonization between European chemical legislation and water/air and industrial legislation, including - place PHS under the authorization regime of REACH”
France	“DEHP on REACH candidate list (annex XIV) but as it is a complex diffuse pollution: measures on discharges are not sufficient to meet EQS. Measures should also be taken for other phtalates and for bisphenol A”
Sweden	“Regulations within REACH about to be decided. It is important that the suggested regulations will be put in place.”

Possible measures

As the baseline data show, production and use of DEHP continue, and result in emissions of DEHP to both water and air. It is expected that waste containing DEHP can also be a source of emissions. If the status of DEHP were to be increased to a Priority Hazardous Substance, it would be necessary to implement further measures to address ongoing emissions. The requirement for a PHS is that all emissions should be phased out, over up to a 20 year period. Table 3.3 lists some measures that might be relevant to reducing or preventing DEHP emissions.

Table 3.3 Possible measures for cessation of emissions

Possible Measure (by source)	BAU? (Note 1)	Technically feasible	Effective to meet proposed EQS (over 2-5 years)	Effective to achieve phase out (within 20 years)	Notes/information sources
Production					
Cessation of production and industrial use	N	Y	n/a	Y	Removes point source industrial emissions. However use of DEHP could still continue if imported
Prevent import of products containing DEHP	N	Y?	n/a	Y	Removes potential mechanism for ongoing use in EU even if production has ceased.
Closed process production	Y?	Y?	n/a	Contributes	Production of DEHP itself already occurs in a closed process. However emissions

Possible Measure (by source)	BAU? (Note 1)	Technically feasible	Effective to meet proposed EQS (over 2-5 years)	Effective to achieve phase out (within 20 years)	Notes/information sources
					still reported in PRTR, so perhaps not 100% effective
Releases in non-sewered areas					
Interception of runoff from roofs, painted surfaces etc and treatment in SuDS	Some	Y (usually)	n/a	Contributes	SuDS would not provide 100% removal efficiency
End-of-pipe treatment					
Secondary STW	Y	Y	n/a	N	Waste water treatment would not provide 100% removal efficiency
Tertiary treatments- e.g. GAC	N	Y	n/a	Contributes	Waste water treatment would not provide 100% removal efficiency but can be significantly improved by tertiary treatment
Use phase					
Substitute use of DEHP (or PVC) with alternative products	Some, but overall No	Y	n/a	Y	Other studies conclude that all aspects of use of DEHP are substitutable with available products. See Table 3.4 for more information
Prevent outdoor use of products containing DEHP	No	?	n/a	Some contribution	Considered in SOCOPSE (2007). However Entec (2008) noted the potential technical infeasibilities with implementation. EU-RAR suggests that equivalent emissions can result from indoor emissions compared to outdoor
Recall of products containing DEHP	N	N	n/a	Signficantly contributes	Removes DEHP in ongoing use from the environment. Due to range of uses, likely to be impractical although Entec (2008) considered the option for outdoor uses on new housing
Control of waste disposal					
Treatment of landfill leachate	Y	Y	n/a	Some contribution	EU-RAR suggests landfill is a minor source proportionally

Notes: (Note 1) - BAU - Business as Usual (i.e. part of baseline)

Table 3.4 Overview of alternatives according a study performed by the TNO (2002) and Myljosstyrelsen (2001) (taken from Entec, 2008)

Application	DEHP alternative	Product alternative
Cables	Di(2-ethylhexyl)phosphate	Polyethylene
	Tri(2-ethylhexyl) phosphate	
	Tri-2ethylhexyltrimellitate	
	Akylsulfonic acid esters	
	DIDP or other phthalates	
	Polymeric plasticisers	
Coated fabrics	Poly ester plasticisers, benzoates, phosphates and other polymers DIDP, DINP	Polyurethane for artificial leather.
		Paper for wall paper.
		Polyethylene for foils and acrylates
Flooring and wall covering, roofing	DINP, polyolefines	Linoleum, rubber, polyolefins, wood and textile (sometimes different functionalities)
	Butane ester	
	Di(ethylhexyl) adipate	
	Trimethyl 1,3-pentanediol diisobutyrate	
Fillers	Polyester	
	Dipropylene glycol dibenzoate	
Medical devices	Trimellitates and citrates(?)	Polyethylene, Polypropylene and rubber
Printing inks	O-acetyl tributyl citrate	
	Dioctyl sebacate	
Toys	Polyethylene	Polyethylene, Polypropylene and rubber

3.1.2 Implementation of measures

Achieving cessation of emissions would require a number of measures to be undertaken. While cessation of production and new use (along with prevention of importation) are the most obvious measures (requiring substitution of DEHP with alternative substances or products), these do not address the existing use or end-of-life phases, which the EU-RAR (KEMI, 2008) calculated to account for over 80% of emissions to wastewater. Measures to address these phases have also been considered in Table 3.3. There is no technically feasible approach to assuring 100% cessation of emissions from the use and end-of-life phases. The use of products in which DEHP is contained may last for more than 20 years, after which DEHP still remains in products when they are disposed of. Complete cessation of emissions would require recall of all products currently in use that could come in to contact with water (including in households or contact with rainwater), and their safe disposal. The range of products containing DEHP, and in some cases their integration within buildings (in roofing materials, for example), would make a return of products almost impossible.

In order to move as far towards cessation of emissions as possible, it is expected that the following measures may need to be considered:

- Cessation of production and industrial use of DEHP in the EU, as well as prevention of importation. This would need to be implemented at a relatively early stage to prevent the introduction of further DEHP into use, which could then remain in use for more than 10 or 20 years;
- Removal of DEHP in wastewater, stormwater runoff and landfill leachate. 100% removal may not be possible, but the majority of DEHP from use and end-of-life phases is expected to enter water through these pathways, and so treatment could significantly reduce emissions even if not complete cessation;
- Removal of products containing DEHP from ongoing use could also be considered.

3.2 Screening of impacts

This section identifies the impacts that are likely to be significant if DEHP were to be increased in status from a Priority Substance to a Priority Hazardous Substance. This assessment takes in to account the baseline discussions above and the range of further measures that may be required to ensure emissions would have ceased (as far as possible) within 20 years.

Table 3.5 Impact Identification Matrix with indication of significant impact in relation to proposed increase in status to PHS

Potential Impacts	Likely to be significant impact that requires further assessment? Yes/No/Possibly	If ‘no’, reason why effect is excluded
Environmental		
Air quality	Yes- emissions to air occur from production and processing sites, which would be prevented if production ceased	-
Water quality and resources	Yes- greater assurance of long-term and widespread compliance with EQS, and further reduction in DEHP concentrations in water	-
Soil quality or resources	Unlikely	Measures would avoid future disposal of DEHP to land. However existing landfill regulations reduce losses of DEHP to soil and groundwater and further benefits may be minor
The climate	No	
Renewable or non-renewable resources	No	DEHP would be replaced with other synthetic substances. Unlikely to be a change in use of resources
Biodiversity, flora, fauna and	Yes- greater assurance of long-term and	

Potential Impacts	Likely to be significant impact that requires further assessment? Yes/No/Possibly	If 'no', reason why effect is excluded
landscapes	widespread compliance with EQS, and further reduction in DEHP concentrations would further reduce risk of impacts for example on reproductive toxicity	
Land use	Possible- increased use of SuDS required to treat stormwater runoff could require significant land-take	
Waste production/generation/recycling	Possibly- increased sludge production due to increased need for wastewater treatment	Amount of DEHP products entering waste will be reduced in future, but products would still exist except with DEHP alternatives, so no change overall
The likelihood or scale of environmental risks	No	No significant change in the scale of environmental risks overall, although consideration needs to be given to potential impacts of substitutes
The environmental consequences of firms and consumers	Yes- cessation of emissions of DEHP would reduce environmental consequences	
Transport and the use of energy	Unlikely	Cessation of production and industrial use could result in increased imports of products containing DEHP. However availability of alternatives within the EU makes this relatively unlikely to be significant
Animal welfare	Possibly- similar to public health, relating to animals drinking untreated water?	
International environmental impacts	No	
Economic Impacts		
Functioning of internal market and competition	Possibly- some impacts could occur due to change from use of DEHP to alternatives. However alternatives already have relatively large share of the market (DEHP estimated 18% of use as plasticizer in polymers) (COWI, 2009)	-
Competition in the internal market	Possibly- see answer above	-
Operating costs and conduct of business/SMEs	Yes- direct impact on DEHP producers. Industrial users likely to be affected by differing costs of alternative plasitcisers	
Administrative costs on businesses	Unlikely	
Property rights	No	Not relevant
Innovation and research	No	Alternatives already exist so significant R&D not required
Consumers and households	Possibly- could be an increase in product prices as a result of higher cost of alternatives to DEHP	-
Specific regions or sectors	Yes- effects on polymer industry	-

Potential Impacts	Likely to be significant impact that requires further assessment? Yes/No/Possibly	If 'no', reason why effect is excluded
Third countries and international relations	No	Unlikely to be relevant. Majority of DEHP use in EU is from production within EU, although prevention of importation could have some impact
Public authorities	Possibly- depending on mechanisms of achieving cessation of production/use, costs to public authorities likely in implementation and enforcement	-
Macroeconomic environment	No	Alternatives available so little effect on market overall
Social Impacts		
Employment and labour markets	Possibly- jobs at DEHP production sites could be affected	-
Standards and rights related to job quality	Possibly- see answer above	-
Social inclusion and protection of particular groups	No	This type of impact is not relevant to proposal
Gender equality, equality of treatment and opportunities, non -discrimination	No	This type of impact is not relevant to proposal
Individuals, private and family life, personal data	No	This type of impact is not relevant to proposal
Governance, participation, good administration, access to justice, media and ethics	No	This type of impact is not relevant to proposal
Public health and safety	Yes- greater assurance of long-term and widespread compliance with EQS, and further reduction in DEHP concentrations would further reduce risk of impacts for example on reproductive toxicity	-
Crime, Terrorism and Security	No	This type of impact is not relevant to proposal
Access to and effects on social protection, health and educational systems	No	This type of impact is not relevant to proposal
Culture	No	This type of impact is not relevant to proposal
Social impacts in third countries	No	This type of impact is unlikely to be relevant to proposal

Note: Table adapted from the EC IA Guidelines

4. Assessment of Costs

This section assesses the costs that could occur as a result of the proposal to increase the status of DEHP to a priority hazardous substance (from its existing status as a priority substance). This section focuses on the impacts that were identified in section 3 as being potentially relevant, based on the assessment of the baseline and further measures that may be required to achieve cessation of emissions of DEHP to the environment.

4.1 Costs to relevant industry sectors

4.1.1 DEHP producers

In order to achieve cessation of emissions to water, production of DEHP would be required to cease. Although it is understood that DEHP production occurs in a closed process, emissions still occur from sites producing DEHP. As identified in Section 2, it has not been established exactly how many producers are still operating in the EU, but it seems to be between 7 and 18. Emissions of DEHP from the chemical industry were reported for 10 sites in 2008. Depending on whether other operations are also carried out at those sites, it is feasible that cessation of production of DEHP could result in closure of those sites, or at least a considerable reduction in operations.

4.1.2 Industrial users of DEHP

As indicated above, it is understood that there are available alternatives that cover the range of current uses of DEHP. In this respect, there would be a relatively low impact on industrial users of DEHP because they would be able to replace it with an already available alternative. However, changing to an alternative product may require changes to production processes and new equipment, so there could still be costs incurred. In addition, there are some differences in unit costs between DEHP and alternatives, as indicated in Table 4.1 (an increase in cost of between 9 and 21% is suggested, based on the alternatives for which data were available). Entec (2008) note that the costs of alternative products may reduce as their use increases.

Table 4.1 Comparative costs of DEHP and (some) alternative plasticizers (from Danish EPA, 2009, in turn taken from COWI, 2009)

Substance	Price	Price relative to DEHP (%)	Substitution factor	Effective relative price (%)	Original data source
DEHP	0.7 US$/Lb	-	-	-	TURI (2006)
DEHP	0.8-1 Euro/kg	-	-	-	ExxonMobil (2009) Arbeitsgemeinschaft PVC (2006)
DINP	0.73 US$/Lb	104%	1.06	111%	TURI (2006)

DIDP	0.77 US$/Lb	110%	1.10	121%	TURI (2006)
ASE	1.75 euro/kg	175%	Not available	Not available	Lanxess (2009)
DEHT	0.74 US$/Lb	106%	1.03	109%	TURI (2006)
DINCH	0.91 US$/Lb	130%	Not available	Not available	TURI (2006)

Overall there is expected to be an increase in costs to industrial users of DEHP. Calculations of these costs have been undertaken in other studies for some relevant industries. These include:

- Entec (2008) reports on the indicative estimates made in the EU-RAR (KEMI, 2006) of the costs of substituting DEHP with DINP in outdoor products. Based on an estimated total quantity of DEHP used in outdoor applications of 100,000t, the additional cost would be around €7 million per year.
- Danish EPA (2009) undertook an assessment of the costs to the electrical and electronics industry that would occur if use of DEHP were to be restricted by the proposal to recast the RoHS Directive. The incremental material costs at the manufacturing stage were estimated to be 0.5-2 million €/y if DINP is used to substitute for DEHP in all EEE. A change to a non-phthalate plasticiser would have higher total costs, likely be in the range of 1-6 million €/y.

4.1.3 Costs to the water industry

The E-PRTR database currently contains records of 149 sewage treatment works emitting DEHP in 2008. Even if there were no new end-products containing DEHP, existing products are likely to remain in use for many years, therefore are also likely to continue being discharged in wastewater, with ongoing emissions in sewage effluent. This means that additional treatment may be required at STWs where DEHP continues to be detected. If the emissions are resulting in a failure of the existing EQS in the downstream waterbody, then the costs for additional treatment should be included in the baseline. However if the emissions do not cause a failure of the EQS, they do not need to be addressed under the baseline, but if DEHP were to be classed as a PHS, even those emissions should be prevented or at least reduced.

Further assessment would be required to establish how the locations of the reported 149 STW DEHP emissions relate to waterbodies failing the DEHP EQS, and hence how many of the STWs would incur costs associated only with the proposed increase in status to PHS. It is also important to recognise the likelihood that DEHP emissions occur from a much larger number of STWs than those that have reported to E-PRTR, including small STWs, individual households not connected to the sewer network, as well as large STWs where DEHP concentrations are below the reporting limit. This could mean costs substantially higher than those associated with the 149 STWs that are currently known about.

To illustrate the scale of costs that could be incurred, some unit costs for advanced wastewater treatment processes are included in Table 4.2. This indicates for example that if the 149 STWs listed above had an average size of 50,000 PE, the cost to install GAC at all 149 sites would be over €1,890 million NPV over 20 years. As noted above, not all of these costs would necessarily be attributable to the proposal to class DEHP as a PHS, since some of the emissions may contribute to failures of the existing EQS downstream and should therefore be addressed in the baseline.

However it is important to note that wastewater treatment would be unlikely to achieve 100% removal efficiency, and as a result some (small) extent of emissions would still be likely to occur. In order to achieve 100% removal of emissions to water, source control would be required. The greater extent to which source control could be used successfully, the less wastewater treatment would be required. This could over time reduce the costs to the water industry in relation to removing DEHP from sewage effluent.

Table 4.2 Unit costs for tertiary treatment (based on Score-PP data)

Population equivalent of STW	GAC (Net present value in €)	UV (Net present value in €)
250	291,255	266,294
500	332,040	304,900
2000	649,797	458,142
10,000	2,620,508	1,279,480
50,000	12,703,078	6,215,961
200,000	40,309,351	16,863,969
1,000,000	170,397,974	65,762,845
1,500,000	213,304,374	82,995,963

NPV includes capital costs of new equipment, plus operational costs for 20 years

4.1.4 Installation of SuDS

The costs of SuDS measures have not been attributed to a specific sector. The sectors affected would be determined by the way that SuDS measures are implemented in each Member State. Examples of sectors that could be bear the costs of SuDS measures include:

- Property development sector – the cost of construction of SuDs measures could initially be borne by developers and the construction industry, although this is likely to be passed on to other sectors (listed below) when developments are completed. However assuming DEHP would no longer be used in new products, i.e. not incorporated in to new developments, this sector may be relatively unaffected;
- Property management sector – maintenance costs for SuDs measures could be borne by the property management sector, although the cost is likely to be recovered from tenants in rent;
- Public sector – construction and maintenance costs for SuDs measures could be borne by the public sector and recovered from society through taxes or other levies;

- Private sector – businesses or homeowners may be required to contribute to construction and maintenance costs, either through the cost of purchase of a property, ground rent, taxation or other levies.

Overall given the likelihood that the need for SuDS would be mostly by retrofitting (i.e. installation to capture runoff from existing developments), rather than new developments (assuming DEHP would no longer be produced or used), the costs may fall more heavily on the public sector or wastewater industries.

Indicative costs for SuDs measures are presented in Table 4.3, based on SCORE-PP research and Environment Agency (2009). The costing assessment was developed to allow comparison between different SuDS on a like-for-like basis. Each scheme was designed to treat 4 Ml/year, but for comparison in terms of land-take, NPV were converted to NPV/m^3.

Table 4.3 Indicative costs for SuDs on a per m^3 treated basis (from Environment Agency, 2009)

SuDs	Construction cost (€)	Annual maintenance cost (€)	NPV (€)	NPV(€)/m^3
Filter strip	€ 12,293	€ 2,831	€ 44,769	€ 11.12
Infiltration basin	€ 27,631	€ 2,831	€ 60,107	€ 14.93
Extended detention	€ 34,468	€ 6,292	€ 106,637	€ 26.49
Detention basin	€ 34,468	€ 2,831	€ 66,939	€ 16.63
Swale	€ 30,218	€ 1,679	€ 47,471	€ 11.79
Infiltration trench	€ 133,106	€ 1,679	€ 152,364	€ 37.85
Permeable paving	€ 192,163	€ 1,551	€ 209,953	€ 52.16

NPV calculated to include capital cost plus 20 years operational costs

Further work would be required to determine the most effective measures at removing DEHP from rainfall runoff. This depends on the solubility and biodegradation of DEHP. Even if the most appropriate measure were identified in terms of efficiency at removing DEHP, there are many other unknowns that would prevent calculation of the cost of measures within the scope of this assessment. The cost of implementing SuDS measures in Member States would depend on a number of factors. Examples include:

- The extent to which SuDS measures are currently incorporated into new developments, and whether new legislation will drive further changes to implementation in Member States (i.e. the baseline);
- The type of SuDS measures currently incorporated into new development, and how effective these are at removing DEHP;
- The extent and density of urban areas, which would determine the feasibility of incorporating SuDS measures into new and retrofitting SuDS to existing developments; and

- Geology, which at a local level may constrain the type of SuDS measures that are available. For example, infiltration SuDS measures are unsuitable for areas with impermeable geology or a high water table.

Besides the direct costs of construction and maintenance of SuDS, further costs may occur in relation to the land-take required for SuDS. This could have some impacts on land-use locally, by affecting the area land available for development.

4.2 Costs to public bodies

Monitoring and enforcement

Costs could potentially be incurred by regulatory authorities in terms of monitoring DEHP in the environment, and in planning and implementing measures.

Since DEHP is already a priority substance, its concentrations in surface waters are required to be monitored by Member States. In addition, DEHP is included in the list of substances for reporting to the E-PRTR database. The requirements for monitoring DEHP emissions and environmental concentrations, and associated administrative burden, therefore may be expected to be altered little compared to the baseline.

However it is probable that regulatory authorities would be required to plan and otherwise contribute towards the implementation of measures. Cessation of production and industrial use of DEHP is most likely to require a ban, and this would require consultation with affected industries and enforcement of the ban when it comes into place. Depending on whether further measures to reduce ongoing emissions are taken up in a MS (i.e. additional treatment on wastewater or stormwater), regulatory authorities may decide to undertake additional investigations and monitoring to consider the effectiveness of the measures, resulting in additional costs.

Schemes to remove products from use

In theory schemes could be considered to remove products containing DEHP from use (i.e. to remove sources of emissions that could remain in use for many years, even if no new production of DEHP were taking place). However given the widespread use of DEHP it may be technically infeasible. An extensive inventory would have to be undertaken of the type of products still in use that could contain DEHP and (likely) a voluntary scheme set up for their recall. It is recognised that Sweden has undertaken this type of programme in relation to PCBs, so it could be feasible, but the extent to which Member States would be likely to take up such a programme cannot be predicted (e.g. it may be considered more economical to allow natural die-out of emissions as products reach their end of life). If such programmes were undertaken, it would be likely that public bodies would bear much of the cost.

4.3 Costs to end users and wider society

4.3.1 Consumers

Due to the relatively ready availability of alternatives to DEHP, allowing end-products to be produced using alternative substances, it is not expected that consumers would experience any difficulties in obtaining end-products. However it is possible that some increases in the prices of products may occur, if producers decide to pass on the costs of switching to and using the alternatives.

As an example, the Danish EPA (2009), in assessing the costs of replacing DEHP in electronic and electrical equipment (EEE), concluded that “substitution may result in slightly raised prices for flexible PVC parts in EEE. For most EEE, the flexible parts which may contain DEHP comprise only a minor fraction of the equipment/product and represent only a minor part of the total production price of the product. Increases in consumer prices for the individual EEE as a result of a restriction of DEHP use in EEE are therefore expected to be small, but a restriction may impact a large share of all EEE.”

As discussed in Section 3, complete cessation of emissions would require the removal of products containing DEHP from use, since use can continue for many years (e.g. in roofing and flooring). A recall on such products would create considerable difficulties for current consumers: however as discussed, it is highly unlikely to be practicable to administer such a recall and this is considered an unlikely measure.

4.3.2 Workers

As discussed in 4.1.1, cessation of production of DEHP could lead to reduced operations or even closure of between 7 and 13 sites across the EU. This could result in a loss of jobs at all of those sites, unless alternative employment can be found.

4.3.3 Human health

The human health implications of alternatives need to be considered, to ensure that the removal of one substance for the benefit of human health is not replaced with another product of similar or greater risk. This has been considered for DEHP substitutes in a number of previous studies, most of which report the same information that is believed to originate from Stuer-Lauridesen *et al*, 2001. This is presented in Table 4.4. An assessment by SCENIHR (2008) has also been reported in more recent studies, as presented in Table 4.5.

The data in Tables 4.4 and 4.5 indicate that there are potential human health impacts associated with alternative substances, although for the majority of substances they are lesser than the impacts of DEHP. The Danish EPA (2009) concluded that:

“Data on alternatives are not sufficient for making a robust conclusion… The available data do however indicate that most of the alternatives are less problematic than the DEHP with regard to human health, but data are missing for critical endpoints, in particular carcinogenicity”.

This suggests that while there is likely to be less impact on human health from alternatives compared to DEHP, further research could be recommended on this before a ban on use is enforced, to ensure that no unintended impacts would occur as a result.

Table 4.4 Overview of the main toxicological and ecotoxicological properties of DEHP and potential alternatives. Taken from Danish EPA (2009), believed to originate from Stuer-Lauridsen *et al* (2001)

Substance	CAS No	Health impacts				Environmental impact		
		Carcino-genic	Muta-genic	Repro-toxic	Sub-chronic toxicity	Persis-tent	Bioaccum-ulative	Aquatic toxicity
DEHP	117-81-7	-	-	Y	Y	-	Y	-
DBP	84-74-2	-	-	Y	Y	-	Y	Y
BBP		-	-	Y	Y	-	Y	Y
ASE		-	-	-	Y	Y	Y	-
ATBC	77-90-7	-	-	-	Y	-	Y	Y
COMGHA	330198-91-9	-	-	-	Y	-	Y	Y
DEGD	120-55-8	-	-	Y	Y	-	-	Y
DGD		-	-	Y	Y	-	Y	Y
DEHT/DOPT	6422-86-2	-	-	-	Y	Y	Y	Y
DINA	33703-08-1	-	-	-	Y	-	Y	-
DINCH	166412-78-8	-	-	-	Y	Y	Y	-
GTA	102-76-1	-	-	-	-	-	-	-
TXIB	6846-50-0	-	-	Y	Y	Y	-	Y

Table 4.5 Comparison of NOAEL for DEHP and alternatives (adapted from Danish EPA, 2009, which was taken from SCENIHR, 2008)

Substance	NOAEL (mg/kg bw)	Reproductive toxicity	Critical endpoint	Genotoxicity	Carcinogenicity
DEHP	4.8	Yes	Reproduction	Negative	LOAEL 320 (male rat)
ATBC	100	No	Decreased body weight	Negative	Negative
COMGHA	5000	No data	Decreased body weight	Negative	No data
BTHC	250	No	Liver weight	Negative	Negative

DEHA	200	Yes	Foetotoxicity	Negative	NOAEL 1250
DINCH	107	No	Kidney	Negative	Negative
DINP	15 (88)	No/Yes	Liver	Negative	Kidney
DEHT/DOTP	500-700	No	Developmental	Negative	Negative
TOTM	100	Yes	Reproduction	Negative	No data

4.4 Costs to the environment

4.4.1 Use of alternatives to DEHP

As discussed above in relation to human health, previous studies have considered the likely health and environmental impacts of alternatives to DEHP. The outcomes of the studies are shown in Table 4.4, where environmental impacts are considered in terms of the persistence, bioaccumulation and toxicity of each substance. Danish EPA (2009) provided the following summary based on the SCENIHR (2008) assessment:

"The available data indicate that a number of alternatives exist which do not meet the PBT criteria, but for which more details and evaluation is necessary… However, based on the Danish EPA assessment, DINA and GTA appear to be more environmentally friendly compared to DEHP, whereas the other 8 substances have positive responses for more than one of the effects: persistence, bioaccumulation and toxicity".

The Danish EPA (2009), in reporting on impacts to the electronics and electrical industry, concluded that "most of the alternatives according to a recent (not yet published) study for the Danish EPA must be considered as more problematic for the environment than DEHP".

This suggests that the change from using DEHP to using alternative substances could result in differing environmental impacts on the environment. Although the scope of this assessment has not allowed any detailed consideration of the nature of environmental impacts of the alternatives, or the extent to which each would be likely to be used, this does suggest the possibility of a significant trade-off occurring between substances. The severity of these impacts should be considered further before a complete cessation of use of DEHP is proposed, in case environmental impacts of a similar or even greater magnitude occur as a result.

4.4.2 Effects of wastewater and stormwater treatment

As discussed in section 3, due to the long lifetime of many products containing DEHP, end-of-pipe measures may be required in order to reduce emissions of DEHP in existing end-products as far as possible. This could require installation of advanced wastewater treatment at locations where DEHP is detected in sewage effluent, as well as improved capture and treatment of stormwater runoff, particularly from buildings with external use of DEHP-containing products.

If there were an increase in the use of advanced wastewater treatment options, other environmental costs may result including:

- Costs of CO_2 emissions;

- Costs of additional sludge production. This would need particular consideration since it is unlikely to be appropriate to apply sludge containing high concentrations of DEHP to land, since the DEHP could be released back in to the environment;
- Damage costs associated with additional energy use.

Due to the uncertainties regarding to the extent to which such an approach would actually be taken up, no costs have been calculated in relation to these points. However unit costs relating to GAC (which has very high removal efficiencies for a wide range of substances) are presented in Table 4.6 as an example. The costs associated with installing a treatment such as GAC could be considerable, particularly given the uncertainty regarding the extent to which such treatment would contribute towards achieving the EQS.

Table 4.6 Unit costs to the environment for aspects that may result from advanced sewage treatment

Environmental consideration	Unit cost	Contributions from GAC for an example Population Equivalent STW of 200,000
Carbon emissions[5]	£52/t (€59.8/t)	2,277 tonnes/yr
Additional sludge production[6] (range takes account of a range of disposal methods including landspreading, landfilling, co-incineration and mono-incineration)	€126-411 per tonne	394 tonnes/yr
Damage costs associated with additional energy use[7]	0.018-0.059 €/kWh	5,297,136 kWh/yr

Construction of SuDS would also require the use of energy and, in some cases, raw materials. Installation of SuDS can also result in significant land-take, and may sometimes be considered impractical for retrofitting in urban areas.

[5] (DECC 2009) - Carbon Valuation in UK Policy Appraisal: A Revised Approach - http://www.decc.gov.uk/assets/decc/What%20we%20do/A%20low%20carbon%20UK/Carbon%20Valuation/1_20090715105804_e_@@_CarbonValuationinUKPolicyAppraisal.pdf

[6] Environmental, economic and social impacts of the use of sewage sludge on land, Final Report, Part II: Reports on Options and Impacts – Report for the EC prepared by Milieu, WRc and RPA. http://ec.europa.eu/environment/waste/sludge/pdf/part_ii_report.pdf

[7] EN35 External costs of electricity production http://www.eea.europa.eu/data-and-maps/indicators/en35-external-costs-of-electricity-production-1

5. Assessment of Benefits

This section assesses the benefits that could occur as a result of the proposal to increase the status of DEHP to a priority hazardous substance (from its existing status as a priority substance). This section focuses on the impacts that were identified in section 3 as being potentially relevant, based on the assessment of the baseline and further measures that may be required to achieve cessation of emissions of DEHP to the environment.

5.1 Benefits to relevant industry sectors

5.1.1 Producers of alternative substances

Producers of alternative substances are likely to benefit as a result of the proposed increase in status of DEHP, if it results in production and use of DEHP ceasing. DEHP currently accounts for around 18% of the plasticizers market (COWI, 2009), which suggests that producers of alternative substances would be able to move in to fill that proportion of the market.

5.1.2 Water industry

Section 4.1.3 illustrates the substantial costs that could be incurred by the water industry in attempting to achieve cessation of emissions of DEHP to water. It is expected that installation of additional treatment at wastewater treatment works may be a necessary measure to address losses of DEHP from ongoing uses that could continue for many years. Although this could be extremely costly for the water industry, it would have the benefit of also removing a range of other substances (depending on those present in sewage effluent at each location after conventional treatment) and hence allowing the cost of compliance to be spread between substances. However this benefit would only be relevant if treatment was required to address emissions that do not cause failures of the existing EQS (i.e. impacts not incurred in the baseline). Clearly this benefit would only be realized if other Priority Substances, or other substances recognized by the water industry as being of concern, were present.

Depending on how widespread the required wastewater measures are, this has the potential to provide relatively widespread improvements to surface water quality overall, not just in reduced concentrations of DEHP. This could ultimately mean that less clean water treatment would be required, allowing the water industry to make savings in other areas.

5.2 Benefits to public bodies

Improved knowledge

It is not expected that there would be any major advances in research and development as a result of the proposed change in status of DEHP, although some smaller areas of R&D would be required (some by private industries in order to adapt to using DEHP alternatives). Within the public sector, the main need for improvements in knowledge is likely to be provision of further assurance of the health and environmental health impacts of alternative substances prior to enforcing a change in practices. As other studies including SCENIHR (2008), Stuer-Lauridesen *et al* (2001), Danish EPA (2009) have noted, the currently available alternatives do have potential health and environmental impacts. Whilst some of these may be lesser impacts than DEHP, and impacts vary between substances, further research could be required to ensure that unexpected adverse effects would not occur as a result of a move away from DEHP.

Overall it would be expected that the benefit to regulatory authorities of enabling reduced concentrations of DEHP in water would be in terms of the public perception of the regulatory authorities to be having a positive effect on the environment (depending on the outcome of the further research suggested above).

Health care

Putting measures in place to further reduce the risk to human health from substances such as DEHP could ultimately feed through to reduced health care costs for Member States. The extent to which this would occur would depend on the extent to which the measures would result in actual health benefits, or whether the focus was on risk reduction.

5.3 Benefits to end users and wider society

5.3.1 Workers

Although cessation of production of DEHP could lead a loss of jobs at the remaining production sites, employment opportunities are likely to occur as a result of the need for increased production of alternative substances.

5.3.2 Installation of SuDS

The installation of SuDS was discussed in Section 4 in terms of potential costs. SuDS can also bring a range of benefits to both society and the environment. The benefits to society depend on the type of SuDS. Some SuDS create new areas of habitat and open space in urban areas, which can provide recreation and amenity opportunities to local residents. SuDS are also installed for the management of flood risk, and so the installation of SUDS would be likely to be designed to also provide stormwater attenuation. If such measures were not already in place, this could provide protection to properties from flooding, and reduce stress on drainage networks. It would depend on a range of factors including the previous land-use, and the other drivers that might result in installation of SuDS regardless of the need to control DEHP concentrations, as to whether these benefits would be realised specifically as a result of the DEHP proposals.

5.3.3 Human health

There is some evidence of carcinogenicity of DEHP (ECHA, 2008), although DEHP is not classified as such and studies have not shown whether the carcinogenicity is relevant to humans. DEHP is identified as being reprotoxic. It has been shown to have effects on both fertility and reproduction in animals, in both sexes, in studies that are considered to be of relevance for humans (ECHA, 2008). Developmental toxicity has been observed in several studies. DEHP can cross the placenta barrier and distribute into foetal tissues. In addition, it has been shown to be capable of transfer through the milk from lactating rats to their pups. Since the immature liver may have a lower metabolising capacity than that of older children and adults, infants and foetuses might be especially vulnerable to exposure to DEHP (ECHA, 2008).

Further reductions in DEHP concentrations in the environment should further reduce the risk of exposure to humans (e.g. through drinking water) and therefore potentially of adverse effects occurring. Given the uses and knowledge of mechanisms for emissions of DEHP, it is suspected that DEHP is more widespread in water than monitoring has so far shown. It is only, therefore, by implementing further measures to reduce emissions across the EU (regardless of whether monitoring data exists and shows failures of the EQS) that this risk can be reduced. The measures ensure reductions in concentrations of DEHP in all environmental compartments in the future, as well as in domestic and occupational settings. Whilst in the short term it is not considered to be possible to remove some routes of exposure, those that occur via water would be the most effectively addressed. Although this benefit should in theory be provided by the existence of the current EQS, its effectiveness depends on the extent to which the need for measures is identified and progressed (i.e. the success of MS monitoring programmes in detecting EQS failures): classification as a PHS would take a precautionary approach to ensuring a reduction and ultimately removal of risk.

In considering the net benefits to human health, the potential for impacts on human health to occur in relation to the use of alternative products to replace DEHP must be considered. This has been discussed in Section 4.3.3. Previous studies consider that overall there seems to be lower risk to human health for the known alternatives, relative to DEHP, indicating there would be a net benefit to human health risks. This has been stated with some reservations (SCENIHR, 2008), suggesting that further work may be necessary for it to be confirmed with confidence.

5.4 Benefits to the environment

Reducing or ceasing emissions of DEHP to water would provide an inherent benefit to water quality, by further reducing the concentrations of pollutants present in water. In particular where additional end-of-pipe measures are required, concentrations of a range of substances as well as water quality parameters such as turbidity could potentially be improved. Some local improvements to air quality could also occur, since DEHP is emitted to air during its production and industrial use.

The existing EQS is set on the basis of the concentrations of DEHP required to ensure no effect on aquatic life. This could mean that no significant further benefits are provided in terms of the direct impact of DEHP on aquatic life, as a result of emissions of DEHP being prevented. However the effectiveness of the existing legislation depends on the extent to which the need for measures is identified and progressed (i.e. the success of MS monitoring programmes in detecting EQS failures): as stated under Human Health above, classification as a PHS would take a precautionary approach to ensuring a reduction and ultimately removal of risk. As noted above, it may be the wider improvements in water quality that could occur as a result of (potentially) widespread increases in end-of-pipe treatment and SuDS that would provide the greater benefit to the aquatic environment in terms of biodiversity, flora and fauna. There may also be benefit to animals living in or drinking water containing DEHP in terms of reprotoxicity, as discussed above for humans.

In considering the net benefits to the environment, the potential for impacts on the environment to occur in relation to the use of alternative products to replace DEHP must be considered. This has been discussed in Section 4.4.1. Previous studies have not been able to conclude that alternative substances would have a lesser impact than DEHP on the environment (in terms of their relative persistence, bioaccumulation and toxicity characteristics). While some of the alternatives are shown to be of lower risk to the environment, those substances cannot necessarily be used in all applications of DEHP, leaving the risk that more harmful alternatives would be selected at least for some applications. Further work may be necessary in order to establish the likely net benefits to the environment.

Installation of SuDS

As discussed above in Section 5.3, the installation of SuDS was discussed in Section 4 in terms of potential costs. SuDS can also bring a range of benefits to both society and the environment. The benefits to society depend on the type of SuDS. Some SuDS create new areas of habitat, improving biodiversity and offering wildlife viewing opportunities in urban locations. SuDS would also help to manage other aspects of water quality in runoff, such as other pollutants or turbidity. It would depend on a range of factors, and the other drivers that might result in installation of SuDS regardless of the need to control DEHP concentrations, as to whether these benefits would be realised specifically as a result of the DEHP proposals.

6. Summary and conclusions

6.1 Background

Di(2ethylhexyl)phthalate (DEHP) is a man-made substance that is used predominantly as a plasticizer, in order to make plastic materials soft and flexible.

DEHP is already classed as a Priority Substance, with an existing EQS of 1.3 µg/l. As a result of DEHP being reprotoxic, being classed as a substance of very high concern (SVHC), and on the basis of the recent EU risk assessment, it has been proposed that its status should be increased to a Priority Hazardous Substance. This would mean that all emissions of DEHP to water should be phased out, within a 20 year period. No changes are proposed to the existing EQS. The purpose of this assessment therefore is to consider the impacts that could be associated with increasing the status of DEHP to PHS.

In order to inform the risk assessment, three Member State-specific case studies were selected to be considered in more detail. The Member States selected were Netherlands, Germany and Hungary. Where relevant, these have been used to present more detail as examples, for example in the baseline. However overall, little additional information has been obtained for these Member States relative to the rest of the EU, and the assessment is predominantly a relatively high-level EU-level assessment. It draws on EU-wide information sources and previous assessments including the EU-RAR, E-PRTR database, questionnaire responses, Danish EPA (2009), COWI (2009), and available Member State-specific studies that are informative at the EU level.

6.2 Basis of assessment

Baseline

DEHP is produced in the EU at somewhere between 7 and 13 sites (different information sources provide different numbers). It is then used in industry to manufacture other products. Approximately 97% of DEHP is used as a plasticizer in polymers, while 2-3% is used in non-polymer products. The use in polymers is predominantly in PVC, which has indoor (e.g. flooring, upholstery) and outdoor (e.g. roofing material, tubing, car under-coating, shoes) applications. Non-polymer uses include as an additive in rubbers, latex, mastics, lubricants, inks and pigments. Some uses are no longer permitted, notably in children’s toys. Although use reduced through early 2000s, there are reports that it has now stabilised, and there is no indication that use would cease under the baseline given existing measures. There are however potential measures being considered that would significantly alter the baseline. Most significantly, DEHP is identified as a SVHC and is a candidate for authorisation under REACH. Depending on the outcome of the authorisation process, use of DEHP may be discontinued. However since the decision to include DEHP in Annex XIV has not yet been finalised, it is not included as a baseline measure.

Calculated emissions from the EU-RAR suggest that around 18% of emissions are from the production and industrial use phases, with over 80% from the use and end-of-life phases. Point-source emissions reported to water in E-PRTR are predominantly from sewage treatment works as a result of diffuse emissions from use upstream. Some emissions are also reported from the chemical and textile industries, i.e. from production of DEHP and products. Other diffuse emissions may occur, particularly from buildings and roads directly to surface water without treatment.

Measures

Achieving cessation of emissions would require a number of measures to be undertaken. Cessation of emissions, at least for a few tens of years, cannot be achieved solely by ceasing production and new use, due to the number of products already in use with long lifespans (such as in roofing and flooring). There is considered to be no technically feasible approach to assuring 100% cessation of emissions from the use and end-of-life phases, but emissions could be reduced by improved treatment of both stormwater and wastewater. In order to move as far towards cessation of emissions as possible, it is expected that the following measures may need to be considered:

- Cessation of production and industrial use of DEHP in the EU, including restrictions on imports. This would need to be implemented at a relatively early stage to prevent the introduction of further DEHP in to use, which could then remain in use for more than 10 or 20 years. Alternatives are already available that are believed to cover the range of uses;
- Removal of DEHP in wastewater, stormwater runoff and landfill leachate. 100% removal may not be possible, but the majority of DEHP from use and end-of-life phases is expected to enter water through these pathways, and so treatment could significantly reduce emissions even if not complete cessation. Measures to remove products containing DEHP from use could also be considered.

6.3 Assessment of impact

Economic impacts

The measures that are proposed above would be likely to result in the following economic impacts:

- Cessation of production of DEHP at between 7 and 13 sites (exact number still operating unknown, as identified above). Depending on whether other operations occur at the site, production may decrease or the sites could close completely;
- There are believed to be commercially available alternatives for all DEHP uses. The producers of those alternatives would benefit from increased production and sales (up to 18% increase in the market share for plasticizers);
- Costs to industrial users associated with changing to alternative substances instead of DEHP. The available unit cost data suggest that the unit costs of alternatives are higher than DEHP. As a result costs to the relevant industries may increase. For example, Entec (2008) concluded that replacing DEHP in all products without outdoor applications would cost around €7 million per year, while the Danish EPA (2009) calculated the costs of replacing DEHP in electronic and electrical

equipment would cost between €0.5-6 million per year, depending on the alternative plasticizer used.

- Due to the widespread nature of emissions from the use phase, emissions are likely to continue occurring from STWs, which may therefore require additional treatment. 149 STWs reported emissions of DEHP to E-PRTR in 2008. As a rough guide, assuming that GAC could be applied to all of those STWs to remove DEHP, and assuming a population equivalent of 50,000, the total costs to the water industry would be over €1,890 million over 20 years. Some of those costs may need to be addressed under the baseline (if they contribute to failure of the EQS in the downstream waterbody). The additional treatment would also remove other substances, allowing the cost of compliance to be spread. However, the STWs currently reporting emissions of DEHP may be only a small proportion of the total;
- Increases in wastewater treatment to the extent that would be required to effectively remove DEHP emissions to water could provide widespread improvements in water quality and allow water industry to reduce clean water treatment;
- Cost of installing and maintaining SuDS, relating mainly to retrofitting (since materials for new developments would no longer contain DEHP). Some costs may fall to developers and owners, but may be borne more by the public sector or water industry. However again there would be multiple benefits (e.g. treatment of other substances, flood risk management, amenity value) and the costs would not be attributed entirely to controlling DEHP emissions. With SuDS increasing due to existing legislation, some measures will be implemented in the baseline;
- Likely costs to regulatory authorities to implement and enforce a ban on production and use of DEHP. If Member States decided to implement measures to remove products containing DEHP in use (which would be likely to involve an extensive programme of work), much of the cost might fall to public bodies.

Social impacts

The proposal to increase the status of DEHP to PHS is based on its classification as reprotoxic. It has been shown to have effects on both fertility and reproduction in animals, in both sexes, in studies that are considered to be of relevance to humans. Since the existing EQS is set predominantly based on environmental requirements, this may not assure the removal of risk to human health, for example through drinking water. The proposed change in status would further reduce the risk of people consuming DEHP in water or food, and the impacts that could result from prolonged exposure. In order to ensure that a net benefit would be provided to human health, the impacts of the alternatives that are likely to replace DEHP also need to be understood. Previous studies have concluded, although with some reservations, that in general the human health impacts of alternative substances are lesser in comparison to DEHP. Overall therefore a net benefit should be realised for human health.

As cessation of production of DEHP could lead to reduced operation or even closure of a number of sites across the EU, this could result in a loss of jobs. However employment opportunities are likely to occur with the producers of alternative products.

Although the costs of using alternative substances in production of relevant end-products could be passed on to consumers, it is expected that any increases would be minor.

Environmental impacts

There is potential for environmental benefits associated with the measures proposed, including local improvements in air quality and potentially widespread improvements in water quality (associated with the removal of DEHP and other substances from sewage effluent and rainfall runoff). Increased use of SuDS could also increase green spaces and provide benefits to wildlife in urban areas.

However when considering the more direct impacts, there is less evidence for environmental benefit compared to human health benefits occurring as a result of this proposal. The existing EQS should already provide sufficient protection to the aquatic environment (i.e. reduce environmental concentrations to below those at which any impacts could occur). Significantly, the alternatives that exist to replace the use of DEHP may cause environmental impacts of a similar magnitude to DEHP. Further research would be required to understand this in detail, but it has been identified in a potential concern in other studies.

6.4 Uncertainties in the assessment

There are a number of uncertainties in the knowledge of emissions of DEHP to water, including:

- Significant emissions are reported from industries for which the use/production of DEHP is not understood. This relates most significantly to the production of cement clinker. More than 4 tonnes of DEHP emissions to air are reported in E-PRTR from this type of facility. In the DEHP literature, only a single reference to cement has been found (COWI, 2009), where alongside “production of ceramics” is also listed “manufacture of other non-metallic mineral products, e.g. plaster, cement”. No further reference to cement is made in the report in terms of the nature or significance of emissions from that source. This may require some further investigation.
- There is uncertainty regarding the number and location of production sites of DEHP remaining in the EU. The number appears to have declined considerably since the 1990s, and the ownership of some sites may have changed, making it more difficult to track. Different studies list different names and numbers of sites and no first-hand information has been obtained in the scope of the assessment;
- The number of STWs at which DEHP emissions might be detected. The relevant STWs would need to be identified before an appropriate programme of measures could be developed. Although emissions are reported to E-PRTR database, smaller STWs do not need to report their emissions. This means there could potentially be a much larger number of sewage treatment works emitting DEHP to water. This could have large implications for the extent of treatment required and associated costs and benefits.

A very significant uncertainty in the assessment is whether authorisation under REACH should be included in the baseline. If DEHP is included on Annex XIV then use of DEHP in the EU could be substantially reduced or even cease altogether. Depending on the timings and the interrelationships between REACH and the Priority Substances Review process, the impacts associated with this proposal could be greatly reduced.

Note in relation to the final report: Since the time of production of the first and second draft reports, DEHP has been included in Annex XIV of REACH. The sections of this final report that discuss the regulation of DEHP have not been altered due to the late stage in the process. However the final report should be read with this recent change to regulation in mind. Since DEHP has been included in Annex XIV, industry must now apply for authorisation for any ongoing use, with a sunset date of February 2015, and deadline for authorisation applications of August 2013.

7. References

Arbeitsgemeinschaft PVC (2006) referenced in Danish EPA (2009)

COWI (2009) Data on manufacture, import, export, uses and releases of bis(2-ethylhexyl)phthalate (DEHP) as well as information on potential alternatives to its use.

Danish EPA (2009) Inclusion of HBCDD, DEHP, BBP, DBP and additive use of TBBPA in annex IV of the Commission's recast proposal of the RoHS Directive: Socioeconomic impacts. Written by Maag, Brandt, Mikkelsen and Lassen, COWI.

ECHA (2009) Prioritisation and Annex XIV background information Bis(2-ethylhexyl)phthalate.

ECPI (2010) DEHP information centre www.dehp-facts/DEHP searched 3 June 2010.

Entec (2008) Water Framework Directive Supporting Plan- DEHP: Final draft report for the Environment Agency, April 2008.

Environment Agency (2009) Potential of SUDS in reducing water related greenhouse gas emissions. Report: SC070010/R4. Bristol. Environment Agency.

European Chemicals Bureau (ECB) (2008) European Union Risk Assessment Report bis(2-ethylhexyl)phthalate (DEHP)

ExxonMobil (2009) referenced in Danish EPA (2009)

KEMI (2006) Risk reduction strategy for bis(2-etylhexyl)phthalate (DEHP)

KEMI (2008) European Union Risk Assessment Report for bis(2-ethylhexyl)phthalate (DEHP).

Lanxess (2009), referenced in Danish EPA (2009)

Myljosstyrelsen (2001) Rerenced in Entec (2008)

OSPAR (2006) Hazardous Substance Series: Phthalates

OSPAR Commission (2008) Towards the Cessation Target: Emissions, discharges and losses of OSPAR chemicals identified for priority action.

SCENIHR (2008) Opinion on the safety of medical devices containing DEHP- plasticized PBV or other plasticierrs on neonates and other groups possibly at risk. Scientific Committee on Emerging and Newly Identified Health Risk (SCENIHR).

Stuer-Lauridsen F, Mikkelsen S, Havelund S, Birkved M and Hansen L (2001) Environmental and health assessment of alternatives to phthalates and to flexible PVC. Environmental Project No. 590. Danish EPA, Copenhagen.

TURI (2006) Five chemical study. Toxics Use Reduction Institute, University of Massachusetts Lowell, for the Commonwealth of Massachusetts. Chapter on alternatives to DEHP available at: http://www.turi.org/library/turi_publications/five_chemicals_study/final_report/chapter_7_dehp

UKWIR (2004A). Priority Hazardous Substances, Trace Organics and Diffuse Pollution (Water Framework Directive): Treatment Options and Potential Costs, Report 04/WW/17/5, UKWIR, London, 2004.

UKWIR (2004b). Priority Hazardous Substances, Trace Organics and Diffuse Pollution (Water Framework Directive): Urban Catchment Study and Assessment of Diffuse Inputs, Report 04/WW/17/3, UKWIR, London, 2004.

TNO (2002) Referenced in Entec (2008)