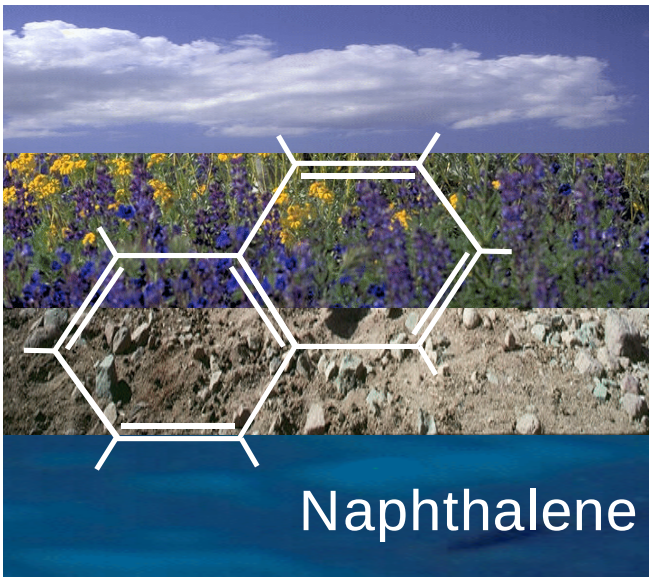
Risk Reduction Strategy and Analysis of Advantages and Drawbacks for Naphthalene



Stage 4 Report

Prepared for
the Department of Environment,
Transport and the Regions

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Risk Reduction Strategy and Analysis of Advantages and Drawbacks for Naphthalene

Stage 4 Report - March 1999

prepared for

The Department of the Environment, Transport and the Regions

by

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EXECUTIVE SUMMARY

This report concerns Stage 4 of a study undertaken for the UK Department of the Environment, Transport and the Regions (DETR) to develop a risk reduction strategy for naphthalene. It has been carried out under the provisions laid down in Europe's Existing Substances Regulation (793/93/EEC) and is required following the identification of certain unacceptable risks in a draft Risk Assessment which has been carried out for the UK government as rapporteurs for this substance.

The draft Environmental Risk Assessment has identified that unacceptable risks may occur through the use of naphthalene in the manufacture of vitrified porous grinding wheels where naphthalene is used as a pore forming agent. These risks relate to the aquatic environment (including sediment), microorganisms in waste water treatment plant and to the terrestrial environment.

Following Stage 2 of this study, it was recommended that Stage 3 (quantitative assessment of options) would not be required because marketing and use restrictions were considered inappropriate to controlling the uses of concern. In this respect, of those companies contacted during consultation, all have either implemented controls on environmental emissions or are in the process of doing so, such that associated risks will soon be within acceptable levels. Nonetheless, formal risk reduction measures are required in order to regulate any installations which have not yet taken action and any new installations which may enter the market in the future.

It was initially considered that additional risk reduction measures would be required in order to control atmospheric emissions of naphthalene from grinding wheel manufacture since these contribute to the terrestrial risk (via atmospheric deposition). However, additional information has been made available which details that this process contributes only 1% to soil concentrations (and thus to risk to the terrestrial environment), with the remainder occurring through deposition of sewage sludge. Therefore, the risks of concern can be adequately addressed through controls upon emissions of naphthalene to water and upon the levels applied to land in sewage sludge.

Marketing and use restrictions (in the form of a ban upon the use of naphthalene in grinding wheel manufacture) are considered inappropriate since they would impose excessive cost burdens upon the industry, including possible loss of entire product lines and subsequent employment.

Integrated Pollution Prevention and Control (IPPC) would, in theory, provide a suitable means for control of the risks of concern. However, the risks associated with naphthalene emissions from grinding wheel manufacture are small in comparison to the other risks to be addressed by IPPC and the desired outcomes could not, therefore, be guaranteed. In addition, IPPC would impose additional burdens upon grinding wheel manufacturers.

The use of voluntary industry agreements for substitution of naphthalene with an alternative substance is considered unsuitable since such a measure would be unlikely to

gain widespread support and companies could not ensure continued production of the grinding wheel products if an alternative to naphthalene were used.

It is concluded that the most appropriate mechanism for control of emissions is under the proposed Water Framework Directive and the proposed amendment to the directive on sludge. Current proposals indicate that this would provide a means to ensure that emissions are adequately controlled since naphthalene is on the proposed list of priority substances under the Water Framework Directive.

Companies contacted have indicated that the investment required to reduce emissions has already been made. This has had a maximum value of Euro 1 million per site. Concurrently, emissions are either already within acceptable levels or will be so in the near future. Therefore, no additional costs would be expected for the manufacturers.

Since the proposed regime under the Water Framework Directive would exist irrespective of recommendations made for use of naphthalene in the use of concern, control by this means would not impose any additional costs to the regulators (who will be required to identify the 'principal sources' of emissions of naphthalene into the environment, as proposals stand).

The Water Framework Directive would control emissions direct to watercourses and also those which occur following treatment in WWTP (and also due to any leaching from areas where it is deposited on soil via sewage sludge). If levels in sewage sludge are controlled under the proposed amendment to the Sludge Directive, this approach will serve to address all of the endpoints of concern.

Control under the Water Framework Directive will allow emissions of naphthalene to the environment to be controlled where they represent 'principal sources' of this substance in the environment. In addition, since the regime of the Water Framework Directive would impose emission limit values (ELVs) in any case, the economic impacts for all stakeholders would be expected to be minimal.

Such an approach will take into account the fact that naphthalene can and is used in the manufacture of grinding wheels without causing any unacceptable risks to the environment. The use of uniform ELVs is, therefore, deemed to be an equitable means of ensuring that risks are within acceptable boundaries both now and in the future.

However, since both of the required legislative means for control are still at a proposed stage, this situation should be reviewed in the event that they are amended such that they would no longer provide an appropriate means of controlling the risks.

Therefore, the proposed risk reduction strategy is as follows:

1. Emission Limit Values should be set for the use of naphthalene in the manufacture of grinding wheels. These would be based upon the Best Available Techniques under the current proposals. Since Member States will be required to identify the 'principal sources' of pollution by priority substances, if risks to

the environment continue to occur in the future then the process would come under control.

2. Levels of naphthalene in sewage sludge should be controlled through the proposed amendment to the Sludge Directive. This would be accomplished by ensuring either that sludge containing excessive levels of naphthalene are not applied to agricultural soil or that the relevant competent authority (e.g. sewage undertaker) places limits upon emissions of naphthalene to sewer.

It is considered that this strategy would provide the most cost-effective and practicable means of ensuring that the actual and potential risks from the use of naphthalene in manufacture of grinding wheels are controlled. In addition, it would require equal levels of emissions across manufacturers and would thus not impose excessive burdens upon individual companies. Furthermore, this strategy will take account of the fact that emissions are controlled to acceptable levels by most (if not all) companies and thus is deemed to be proportionate to the severity of the risks (since the mechanisms will be established irrespective of the above requirements).

In the case that the proposals which are finally adopted no longer contain the appropriate means to address the risks of concern, the strategy will need to be reviewed.

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1. BACKGROUND

1.1 Introduction

Under the Existing Substances Regulation 793/93, naphthalene is on a priority list of substances which has been drawn up for risk assessment[1]. As rapporteur, the UK is responsible for conducting an assessment of risks associated with the use of naphthalene as concerns human health and the environment. Where unacceptable risks are identified, the UK must also develop a risk reduction strategy for the management of those risks.

The environmental Risk Assessment[2] for naphthalene has identified unacceptable risks associated with the use of naphthalene in the manufacture of grinding wheels. This conclusion is based upon site-specific information and relates to one site only, although other such sites may have similar associated risks. The need to control emissions from new facilities using this manufacturing process has also been explicitly recognised in this risk reduction strategy report.

Previous drafts of the Risk Assessment report indicated a potential concern as regards the use of naphthalene in the manufacture of moth balls. Further investigation into the manufacturing process has since revealed that risks to the environment are within acceptable boundaries.

Risk & Policy Analysts Ltd (RPA) has been contracted by the UK Department of the Environment, Transport and the Regions (DETR) to develop the environmental component of the risk reduction strategy for naphthalene.

This risk reduction strategy has been carried out in accordance with the *Technical Guidance Document on Development of Risk Reduction Strategies* issued by the European Commission (1997). Under the terms of the contract, the risk reduction strategy comprises four stages:

- stage 1 comprises evaluation of the uses of concern from the risk assessment and risk reduction measures taken so far. Establishment of the range of potential risk reduction options;
- stage 2 involves a systematic qualitative assessment of the advantages and drawbacks for each option identified;
- stage 3 requires either (i) a semi-quantified assessment examining one or more options as appropriate, or (ii) a fully quantified assessment examining one or more options as appropriate; and

[1] Commission Regulation (EC) No 1179/94 of 25 May 1994 concerning the first list of priority substances as foreseen under Council Regulation (EEC) No 793/93.

[2] The Environmental Risk Assessment has been agreed at a technical level and is due for further review later in 2000.

- stage 4 involves preparation of the final risk reduction strategy.

A report was produced in November 1999 which detailed findings of the Stage 2 assessment (RPA, 1999). Following discussions with the DETR it was concluded that Stage 3 of this study would not be required. This report, therefore, details the proposed final risk reduction strategy for naphthalene.

1.2 Use Pattern of Naphthalene

Determination of the use pattern of naphthalene has been obtained from the draft Risk Assessment report (Environment Agency, 1999) and through consultation with industry undertaken during Stages 1 and 2 of this study.

This study is concerned with the use of naphthalene as a commercial product and associated risks to the environment. Naphthalene is also a by-product of other processes, such as combustion, and this may lead to high concentrations in and around heavily industrialised areas. This is discussed in more detail in a later section.

The draft Risk Assessment gives a total value for manufacture of naphthalene in the EU as 200,000 tonnes per annum (tpa). Of this, a significant proportion is exported and total use is approximately 140,000 tpa. Data for the various uses of this substance have been compiled in the Risk Assessment report and are outlined in Table 1.1.

The total figure for use is slightly larger than that quoted above. As stated in the Risk Assessment, this may be because 2-naphthol is used as an intermediate in the production of azo-dyes (under "dyestuffs").

Of this total, approximately 350 tpa is used in the manufacture of grinding wheels. Use of naphthalene for this purpose is the only use for which unacceptable risks have been identified for the environment. This risk reduction strategy, therefore, concerns only a very small proportion of naphthalene use in the EU and the extent of the risks is accordingly limited.

Table 1.1: Uses of Naphthalene as Set Out in the Draft Risk Assessment Report	
Use	**Quantity Used Annually (tpa)**
Phthalic anhydride	40,000
Dyestuffs	46,000
Naphthalene sulphonic acids	24,000
Alkylated naphthalene solvents	15,000
2-napthol	12,000
Creosote	10,000
Moth balls	1,000
Pyrotechnics	15
Grinding wheels	350
Others	4,000
Total	**152,365**

1.3 Use of Naphthalene in Grinding Wheels

1.3.1 Background to Use in Grinding Wheels

Naphthalene is used to introduce pore spaces in certain types of grinding wheels. The presence of pore spaces improves the performance of these abrasive products by making more of the sharp edges in the abrasive 'grits' (usually aluminium oxide, Al_2O_3) available for the cutting action.

The products in which naphthalene is used are known as 'bonded' abrasives in that the grits are bound together using a vitrification process. Figure 1.1 describes the 1996 abrasives market for bonded abrasives as compared to 'coated' abrasives (such as sandpaper) and 'superabrasives' (which are used for particularly arduous tasks and contain diamonds, CBN[3], etc). This figure is based on AMA (1997). The value of all three types of abrasives is known to have grown slowly during 1997 and 1998 but to have suffered a significant drop in sales, particularly for bonded abrasives, during the first three quarters of 1999.

[3] Cubic Boron Nitride.

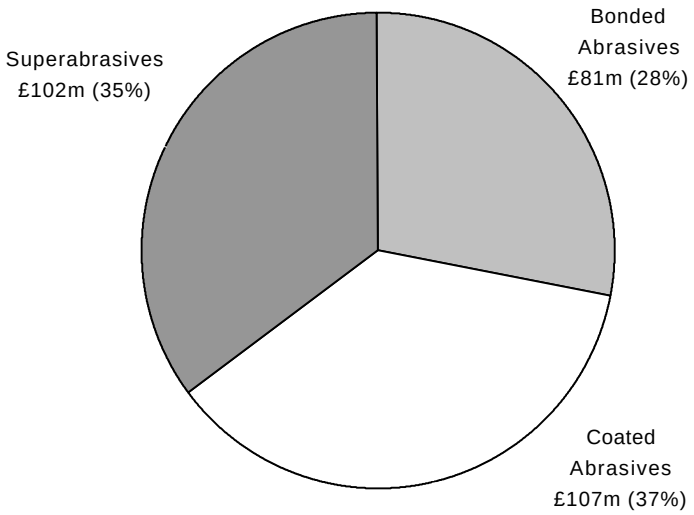

Figure 1.1: Segmentation of UK Abrasives Market, 1996

The grinding wheels in question are based upon aluminium oxide grits along with ceramic materials such as clay or feldspar and, of course naphthalene. Typical percentages of a (wet) product are detailed in Table 1.2.

Table 1.2: Typical Composition of Bonded Abrasives Using Naphthalene

Component	Percentage
Aluminium Oxide	50%
Ceramics	30%
Naphthalene	20%

The wheels are formed by introducing the mixed (ideally evenly distributed) materials into a mould. This is then heated moderately (60-100°C) for several hours in order for the naphthalene to be volatilised. This volatilisation leaves the required pore spaces within the wheel. The product is then fired under pressure at around 1200°C in a kiln to vitrify the ceramic materials by binding the aluminium oxide grits together while leaving the pore spaces created by naphthalene. Naphthalene, therefore, is not a component of the final product.

1.3.2 Scope of Consultation Exercise

RPA has consulted with companies involved in the manufacture of grinding wheels in the UK and also in several other EU Member States. This has involved contact with trade associations representing abrasives manufacturers in the Member States and also with manufacturers themselves. A number of companies which manufacture grinding

wheels but which do not use naphthalene have provided information for this study (a list of consultees is given in Annex 1).

In total, 59 companies and organisations have been contacted with the majority being manufacturers of abrasives (37 companies). Table 1.3 describes the numbers of abrasives manufacturers contacted by EU Member State.

Table 1.3: Number of Abrasives Manufacturers Contacted

Country	Number of Companies
UK	15
Austria	6
Italy	11
Sweden	2
Netherlands	1
France	1
Spain	1
Total	37

In addition, there are several Member States where no manufacture of vitrified abrasives is thought to occur (for example, the Norwegian abrasives federation has responded that there are no manufacturers of grinding wheels in Norway).

To date, four companies have been identified as using naphthalene for the manufacture of grinding wheels (this figure includes the three sites described in the Risk Assessment). Information has also been received from trade associations which have provided representations for their members but which have not provided any information on uses.

1.4 Past Control of Naphthalene

Naphthalene is a priority substance for control under List I of the Dangerous Substances Directive (76/464/EEC) for emissions to water. Since no harmonised measures have been developed as yet, Member States are required to implement controls. This has been undertaken in a number of countries; for example through a statutory environmental quality standard in the UK.

Naphthalene is also on a list of priority substances for future control by the North Sea Convention and is recognised as requiring control for some uses in some countries under the OECD's assessments of high production volume (HPV) chemicals.

Occupational exposure limits have been developed for its use in the manufacture of grinding wheels in a number of Member States. Similarly, emissions to the environment are controlled from some installations at a local level (e.g. Local Authority Air Pollution Control in the UK).

2. THE RISK ASSESSMENT

2.1 Background

This section describes the findings of the Environmental Risk Assessment as detailed in the Draft Risk Assessment report of February 1999 (Environment Agency, 1999). The report has classified the environmental risks associated with the use of naphthalene according to the methods set out in the Technical Guidance Document (European Commission, 1997). A requirement for risk reduction measures was recommended on the basis of a comparison of predicted environmental concentrations (PECs) and predicted no-effect concentrations (PNECs). The degree of certainty involved in determination of these values and the specific effects of the chemical are also taken into account in reaching one of the following conclusions:

i) There is a need for further information and/or testing;

ii) There is at present no need for further information and/or testing or for risk reduction measures beyond those that are being applied already; or

iii) There is a need for limiting the risks; risk reduction measures which are already being applied shall be taken into account.

This section is primarily concerned with the description of those uses for which the third of these recommendations has been made.

2.2 Hazardous Effects of Naphthalene

The hazardous effects of naphthalene to the environment are set out in Section 3.2 of the Risk Assessment report. Predicted no-effect concentrations have been calculated for aquatic ecosystems (water and sediment), terrestrial ecosystems and waste water treatment plant (WWTP), in accordance with the relevant Technical Guidance. These have largely been based upon acute toxicity testing data although some chronic data were also employed.

Naphthalene has been found to inhibit the growth of aquatic plant species. Effects upon fish and aquatic invertebrates are suggested to occur through narcosis. The PNEC for water of 2.4 µg/l has been based upon the lowest NOEC value of 0.12 mg/l which measured weight gain in coho salmon fry over 40 days (the recommended assessment factor of 50 was used).

The PNEC value is similar to the provisional ecotoxicological assessment criterion agreed by OSPAR of 1-10 µg/l and an EQS of 1 µg/l recommended by the Scientific Advisory Committee to the Commission.

The PNEC for microorganisms in WWTP of 2.9 mg/l was calculated from an EC_{50} determined for toxic effects upon nitrifying bacteria. A PNEC for sediment of 70.9 µg/kg was calculated using an equilibrium partitioning method.

The terrestrial PNEC value was again calculated using equilibrium partitioning coefficients and has a value of 56.3 µg/kg. This method was used since the available toxicity data was sparse and did not include long-term toxicity tests.

In terms of atmospheric effects, no PNEC was calculated. Other environmental effects such as global warming, stratospheric ozone depletion or acidification were deemed to be inconsequential although naphthalene may contribute to tropospheric ozone creation.

2.3 Routes of Exposure

In the Risk Assessment, exposure to naphthalene has been considered against the background of the various uses for this substance and also through its unintentional release as a by-product of other industries. Environmental exposure has been calculated either using measured values associated with emissions from use of naphthalene and/or derived values which have been calculated using the methods specified in the Technical Guidance Document.

It is important here to place into context the levels of exposure referenced and derived during the Risk Assessment. For the aquatic and terrestrial compartments, high levels of naphthalene have been measured in the environment but these predominantly relate to areas of heavy industrialisation. In these locations, naphthalene enters the environment from combustion sources, aluminium manufacture, etc. The measured levels have not been directly associated with the production of naphthalene as a chemical or its use in the various industries of concern (although some relatively high levels have been measured).

Because of the high background levels in the environment, site-specific data on emissions were collected for the Risk Assessment. This data was used to calculate PEC values for the various environmental compartments. PEC values were derived by using this site-specific data and employing the methods recommended in the Technical Guidance Document.

The PEC values for the terrestrial environment are determined by using deposition rates for input from the atmosphere and from sewage sludge, with the latter being considered the primary input[4].

[4] Since completion of the Stage 2 report, further clarification has been given as to the relative contributions of deposition rates from the atmosphere and from sewage sludge. Although both emissions are used in estimating concentrations in soil, and hence the risk to the terrestrial environment, the soil concentration due to atmospheric deposition contributes only 1% to the soil concentrations and on its own would not give rise to a risk (99% of the soil concentration comes from application of sewage sludge, and so indirectly from releases to water).

2.4 Populations and Ecosystems of Concern

In the Risk Assessment and according to the relevant Technical Guidance (European Commission, 1996), the populations/endpoints for which risks are assessed should be as follows:

- aquatic compartment, including surface water, groundwater, drinking water, sediment;
- terrestrial compartment (natural and agricultural soil);
- atmospheric compartment;
- secondary poisoning ('non compartment specific effects relevant for the food chain') for both aquatic and terrestrial routes of exposure; and
- microorganisms in waste water treatment plant.

As stated previously, data used to calculate the relevant PEC values for the separate uses and production methods of naphthalene include site-specific emissions for those industries and/or default values which are specified in the Technical Guidance. Of the three conclusions which may be reached in the risk characterisation, conclusion (iii) - i.e. a need for further risk reduction measures - is only reached for the use of naphthalene in the manufacture of grinding wheels.

This conclusion relates to effects upon water, sediment, the terrestrial environment and microorganisms in waste water treatment plant (WWTP). It relates to site-specific information from one site only (though other, unidentified, sites may pose similar risks). A determination of risks of secondary poisoning has not been conducted because, as stated in the Risk Assessment (section 3.3.4), naphthalene does not carry the risk phrases T or T+, R47, R48 or R60-63.

During Stage 2 of this study, it was believed that emissions to the atmosphere would require further control due to the effect of atmospheric deposition upon soil concentrations (and thus risk to the terrestrial environment). Since then, however, it has been clarified that atmospheric deposition contributes only 1% to the terrestrial risk with the remainder occurring as a result of the application of sewage sludge (through naphthalene passing from grinding wheel manufacturing sites to WWTP). Emissions to the atmosphere do not, therefore, require further control.

Furthermore, other emissions (to the aquatic environment and WWTP) are, in the majority of situations, controlled such as to cause no unacceptable risks. It is anticipated that this will be the case in the near future for *all* of the sites which have been considered during the risk assessment and also during this study.

Due to a lack of relevant toxicity data, the PNEC values for sediment and the terrestrial environment were calculated by relating concentrations to the relevant concentrations for water. This involves use of the equilibrium partitioning method as specified in the Technical Guidance Document.

2.5 Imminence and Degree of Risks

It should be reiterated here that, where risks to the environment have been identified, these conclusions have been reached using site-specific, worst-case data for one site only and that such risks have not been identified for other similar sites. Furthermore, through a investment in emissions reduction, it is likely that emissions from the site in question will be reduced to levels which do not pose unacceptable risks in the near future. However, it is the case that some sites using the process in question may not have been identified or that new facilities using naphthalene in the manufacture of grinding wheels may open in the future.

The PEC/PNEC ratios for the compartments of concern (for the manufacture of grinding wheels) are as follows:

Water:	122
Sediment:	122
Soil:	67.7
WWTP:	1.48

Note that the values for water and sediment are the same. This is because both PEC and PNEC values for sediment were derived from the corresponding water values using the equilibrium partitioning method which is accepted for use in the Technical Guidance Document.

Historically, atmospheric emissions of naphthalene from grinding wheel manufacture have been of significant concern due to their local nuisance effect (facilities are often located in relatively heavily populated areas). Clarification of the findings of the Risk Assessment and consultation with industry has revealed that these emissions appear to be well controlled with all sites having incinerators/afterburners in place. These emissions have been calculated in the Risk Assessment as contributing only a small amount to the degree of risk (to the terrestrial environment).

Therefore, all of the risks identified for which the PEC/PNEC ratio is greater than one are based primarily upon emissions of naphthalene to water. Based upon the PEC/PNEC ratio, risk to the terrestrial environment could be eliminated through reduction in emissions to water alone.

PEC/PNEC ratios were calculated for the Risk Assessment using site specific data on emissions obtained from companies manufacturing grinding wheels. Values for one out of three of these companies led to the conclusion that risks were unacceptable. Since the risks are not industry-wide, any risk reduction measures must target those facilities which are causing the highest emissions whilst not disadvantaging those which pose no unacceptable risks.

Measures should also provide for controls on companies which might cause unacceptable emissions in the future (e.g. where new sites using naphthalene are brought on line). This

is discussed in detail in those sections of this report which provide the arguments for selection of appropriate risk reduction measures (sections 4, 5 and 6).

This is particularly important in relation to information obtained through consultation with industry: it is envisaged that environmental risks associated with all of those sites which have been considered will be within acceptable levels in the near future. Nevertheless, the potential for risks to occur from future facilities will require suitable management through a legislatory framework.

2.6 Level of Certainty in Risk Assessment Results

In the sector for which unacceptable risks have been identified (manufacture of grinding wheels), the Risk Assessment has been based upon data provided by industry. Though these data have been treated in accordance with the Technical Guidance Document, the levels of emissions very much relate to a worst case scenario.

In addition, as concerns emissions from the manufacture of grinding wheels, data used in conducting an assessment of exposure are based upon site-specific information from one site only. These data are again understood to represent a worst case scenario at this site.

During consultation, the calculations used to determine the PEC values associated with the manufacture of grinding wheels have been queried since they apparently relate to data which is now out of date. However, the methods employed are rigorous enough to indicate that such a manufacturing process has the *potential* to cause unacceptable risks. Therefore, the demand for risk reduction measures remains in order to tackle any outstanding risks and any which may occur in the future.

2.7 Implications for Risk Reduction Measures

Since risks to all environmental compartments arise predominantly from emissions to water, risk reduction measures should be targeted mainly at reducing such emissions. Risks arising from emissions to air contribute only to those risks for the terrestrial environment and contribute only 1% of environmental concentrations for that compartment.

Emissions to air still require control for any new facilities which may begin operations using naphthalene in the manufacture of grinding wheels (since this has historically caused local nuisance problems and because such emissions could also contribute to terrestrial concentrations to a greater extent).

However, there appears to be a suitable mechanism in place at sites manufacturing grinding wheels for atmospheric emissions to be controlled. These emissions are controlled on a localised level. Evidence for this is provided by the fact that the risk assessment identified no risk for the atmospheric compartment and that atmospheric

emissions do not contribute significantly to concentrations in other environmental media (i.e. the terrestrial environment). In addition, consultation for this risk reduction strategy has indicated that atmospheric emissions will in fact be lower than those assumed for the risk assessment due to the introduction of newer emissions control technology.

3. CURRENT RISK REDUCTION MEASURES

3.1 Introduction

In this section, the regulatory and other measures which are currently in place to control the risks associated with naphthalene are reviewed. These include measures which target the manufacture and use of naphthalene as a chemical. They also include those which are in place to reduce the risks in general associated with the use of concern (manufacture of grinding wheels) and those specific to naphthalene use in this sector.

It is important to recognise that concentrations of naphthalene in the environment are not exclusively associated with the use of naphthalene as a commercial product. Naphthalene also enters the environment as a by-product of combustion of a range of hydrocarbon fuels. The Existing Substances Regulation (793/93) states that:

> "substances means chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition."[5]

Therefore, the Risk Assessment process can only examine exposure and effects associated with substances where they are specifically produced for use as commercial products and not where they occur as by products of, for example, combustion. Risk reduction measures are, therefore, limited accordingly to where naphthalene is used as a commercial product.

3.2 Regulatory Controls Upon Naphthalene

Naphthalene is on the list of 129 substances which are contained in a Commission Communication to the Council of 22 June 1982[6] concerning dangerous substances which are priority substances to be included in List I (the "black list") of Directive 76/464/EEC[7]. It, like many of the other substances on this list, has not yet had the relevant standards set and should therefore currently be treated as a List II ("grey list") substance, i.e. one for which pollution should be *reduced* rather than *eliminated*.

Until such time as harmonised standards are defined for naphthalene on an EU-wide basis, Member States are responsible for discharges of naphthalene to the aquatic

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5 Council Regulation (EEC) No 793/93 of 23 March 1993 on the evaluation and control of the risks of existing substances, Article 2(a).

6 OJ No C 176, 14.7.1982, p. 3.

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

environment. In the UK, a statutory environmental quality standard (EQS) of 10 µg/l was introduced in February 1998. This value is higher than the aquatic PNEC of 2.4 µg/l derived in the Risk Assessment. However, this should indeed be the case since the EQS is an annual average and takes account of temporal variations in concentrations.

Naphthalene is also on a list of chemicals which was agreed at the third North Sea Conference. It is not contained in Annex 1A of the relevant declaration[8] which contains the "list of priority hazardous substances" but rather in Annex 1D which details "priorities for future measures." Inclusion on this list may have had some bearing upon the inclusion of naphthalene on the priority list under the Existing Substances Regulation.

Directive 80/68/EEC sets out two lists of substances which should be controlled in terms of their emissions to groundwater. These lists are largely the same as those which are contained in Directive 76/464/EEC. List I contains substances for which Member States should take the necessary steps to prevent introduction into groundwater, as compared to those in List II for which introduction to groundwater should be limited. "Hydrocarbons" are included on List I and this term can be taken to include naphthalene. In the proposed Water Framework Directive[9], naphthalene has been included on the most recent proposed list of priority substances (see Section 4.2.3).

3.3 Regulatory Controls Upon Manufacture of Grinding Wheels

Controls upon sites at which naphthalene is used in the manufacture of grinding wheels are, where applicable, often defined at a local level. For example, in the UK, emissions to air are restricted by local authorities, while discharges to the water environment are regulated through discharge consents.

In relation to this point, emissions of naphthalene from this process have reportedly caused significant problems in terms of local nuisance. This has been an issue because the sites in question are generally situated in relatively heavily populated areas. Local controls on atmospheric emissions have, therefore, been introduced which have reduced or eliminated this risk.

3.4 Other Existing Risk Reduction Measures

The OECD has been conducting an assessment of the risks to human health and the environment from various high production volume chemicals, one of which is naphthalene.

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8 **Ministerial Declaration of the Third International Conference on the Protection of the North Sea**, The Hague, 8 March 1990.

9 Proposal for a Council Directive establishing a framework for Community action in the field of water policy, COM (97) 49 Final as amended by COM (97) 614 Final and COM (1998) 76 Final.

Initial assessments by the OECD place naphthalene in a group of 10 chemicals for which further risk management might be required for certain use and release situations in some countries. In a 1998 document, the following statement was attached to this classification:

> "If a particular risk is not yet managed adequately in a Member Country, the government and domestic chemical industry are encouraged to work together to facilitate the management of the risk posed by these uses and/or other releases. Governments are encouraged to report to the OECD policy body on chemical safety on their progress" (OECD, 1998).

The industry has itself also implemented significant controls upon emissions of naphthalene from grinding wheel manufacture. This has included, for example, reduction in emissions through more efficient incineration of exhaust gases containing naphthalene. The majority of companies contacted appear to advocate a continuing improvement in their own environmental performance. Such action appears to have been taken partly through requirements by local regulators and partly through industry recognition that improved environmental performance is recognised and commended by others in the chain of trade.

3.5 Overview of Effects of Existing Risk Reduction Measures

It is important to recognise at this stage that those measures which already affect manufacturers of grinding wheels have had significant effects upon the risks associated with emissions of naphthalene to the environment.

Consultation with industry has indicated that those grinding wheel manufacturers which use naphthalene are very aware of the *potential* risks associated with its use, both to human health and to the environment. It appears to be the case that emissions reduction has been undertaken in response to requirements by local and/or national regulatory authorities and also through 'voluntary' steps taken following environmental auditing, etc[10].

Emission controls generally take the form of incineration of the product at temperatures of around 750 to 875°C. Incineration is generally sufficient to reduce emissions to below 1-2 ppm (i.e. around 5-10 mg/m^3), a level which is not deemed to pose any significant risks by both operators and local regulators.

Emissions of naphthalene to water are controlled in the majority of sites (as highlighted by the fact that unacceptable risks were only identified using worst-case data and applied to one site only). As with emissions to air, those to water are within acceptable boundaries for the majority of sites and are expected to be so for all sites which have been considered (in the Risk Assessment and this strategy) in the near future.

[10] Such as through the EU Eco-Management and Audit Scheme (EMAS).

Companies contacted have all invested heavily in introducing emissions reduction programmes, with investments appearing to be of a similar magnitude, ranging up to Euro 1 million (£0.64m).

4. POSSIBLE FURTHER RISK REDUCTION MEASURES

4.1 Introduction

This section details several mechanisms which could be used to reduce the risks associated with the use of naphthalene in grinding wheel manufacture. These are largely based upon a selection of the measures which are detailed in the Technical Guidance Document. Groups of measures which have not been considered have been excluded using arguments detailed in this and the following sections.

Risk reduction measures which have been considered in detail are as follows[11]:

- environmental quality standards and/or emission limit values;
- integrated pollution prevention and control;
- restrictions upon marketing and use; and
- industry environmental agreements.

A general background for each of the above measures is described below. In Section 5, which details the assessment of possible risk reduction measures, possible methods for implementing each measure are described.

There is a number of risk reduction measures which have not been considered here in any detail because it is immediately evident that they do not fit the particular circumstances of the risks of concern.

Firstly, risk reduction measures related to packaging, distribution and storage do not target the appropriate stage in the life-cycle of naphthalene and its use in grinding wheel manufacture. The same applies to domestic and consumer use. Of the measures detailed which target waste management, the only ones which would appear to be appropriate would be "specified disposal methods and/or conditions, for example, incineration (temperature and time)" and "end of pipe controls". These are not considered individually but rather within the sections describing emission limit values and integrated pollution prevention and control. This is because, due to the nature of naphthalene's use, it is used and then immediately becomes a waste product.

[11] Previously, this study considered the need for 'control of atmospheric emissions at a local or national level'. As mentioned in Section 3.5, grinding wheel manufacturers have generally reduced emissions at the behest of local authorities. Since it has been clarified that atmospheric emissions will not require control in order to address terrestrial risks, this option is no longer deemed to be required.

4.2 Environmental Quality Standards and/or Emission Limit Values

4.2.1 Introduction

Traditionally, there have been two types of possible instrument available for meeting the requirements of European law on discharges of dangerous substances to water; these are environmental quality standards and emission limit values. The legal basis for this currently resides in Directive 76/464/EEC[12] which allows for discretion as to the measures employed to eliminate and/or reduce pollution caused by certain dangerous substances. However, the proposed Water Framework Directive will significantly change the current situation, requiring a more harmonised approach across the EU.

Below, the current approach (under Directive 76/464) is described in more detail. This discussion is followed by a consideration of the proposed changes to the regime under the proposed Water Framework Directive.

4.2.2 The Dangerous Substances Directive

Directive 76/464/EEC outlines two groupings of chemicals for which pollution should be controlled either through 'elimination' or through 'reduction' depending upon the nature of each chemical's toxicity and its use and also upon the level of information available in order to take such measures.

As mentioned previously, the Directive allows for the use of two types of mechanism to meet these objectives:

- emission limit values (ELVs) are used to specify the maximum allowable concentration of a particular pollutant in effluent and/or the maximum amount to be discharged over time; and

- environmental quality standards (EQSs) are used to specify a level of pollutant in the receiving environment at which no adverse effects are expected to occur. The EQS is set in order to achieve an overall environmental quality objective (EQO) for a target environment and can apply on a variety of levels (e.g. local, national, international).

The primary difference between the two is that ELVs focus upon the sources of pollution whereas EQSs are intended to control pollution of the receiving environment. Limit values can be imposed upon industries discharging a particular substance such that the receiving environmental medium (usually water) meets the relevant EQS.

Under the Directive two lists of substances have been developed. The first of these, List I ('black list'), includes substances considered particularly dangerous especially in terms of their toxicity, persistence and bioaccumulation. For these substances, pollution should

[12] Council Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community.

be eliminated. For List II substances ('grey list'), pollution should be reduced. List II substances are either those which are considered less dangerous or for which no daughter directive has been introduced. In addition, as mentioned previously in this report, a list of 129 substances was added in 1982 which are priorities for inclusion on List I but which should, prior to development of suitable quality standards and emission limit values, be treated as List II substances.

For List I substances, pollution should be tackled through the introduction of these daughter directives. List II substances should be controlled through measures taken at Member State level. In the UK for example, List I substances have been addressed using EQSs through the Surface Waters (Dangerous Substances) (Classification) Regulations 1989 (as amended) whereas List II substances have undergone control using statutory EQSs through which the Environment Agency operates a discharge consent system. As previously stated, naphthalene - being on the 1982 list of 129 substances - is a priority candidate for inclusion on List I but, in the interim, is treated as a List II substance.

Use of EQSs has tended to be the approach favoured in the UK whereas ELVs have been more widely adopted in other Member States. Use in the UK of variable emissions standards set locally to meet a local EQS can be said to target measures effectively where they are required. It allows for the consideration of diffuse sources of pollution since it concentrates upon impacts upon the environment. The inherent flexibility affords the ability to target sensitive areas and thus to be economically efficient for operators. However, EQSs require continuous monitoring of the environment which is often complicated and expensive. Also, breach of EQSs in a particular area may not reveal the cause of the pollution. Furthermore, in areas where the particular EQS is met, there may be no incentive for technological improvement to further reduce emissions. In this respect, effective use of EQSs generally requires different levels of protection depending upon local conditions.

The centrally determined use of ELVs, by contrast, may be cheaper and easier to impose, implement and monitor, as discussed further in Section 5. It also allows equity between operators since the same discharge limit applies to each.

However, ELVs may not be able to adequately deal with the cumulative effect of discharges of a substance by several operators within a particular area. This would seem particularly applicable to the use of naphthalene in grinding wheels since there are numerous other sources of emission to the environment. This problem may be rectified, however, through the use of local emission standards linked to an EQS (the so-called 'bubble' approach).

Some legislation and agreements have tried to take advantages of the benefits of both EQSs and Limit Values in order to provide a sufficient degree of environmental protection in a manner which is economically efficient and also equitable. For example, the North Sea Conference has stated that, for emissions of 'red list' substances into the North Sea, the most stringent of the two standards should apply. Also, Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC) has required that emission limit values be set for substances contained in Annex I of the Directive and also

that, where statutory EQSs exist, IPPC permits must take these into account in requiring supplementary provisions. These provisions should, however, recognise that other measures will often be necessary to meet an EQS than simply the control of a particular discharge since numerous diffuse sources may contribute to environmental burdens of a substance.

4.2.3 The Proposed Water Framework Directive

Despite the fact that this Directive has, at the time of writing, not yet been finalised or adopted, it requires consideration because it will significantly change the way in which emissions of dangerous substances to water are controlled and is likely to contain specific provisions as concerns naphthalene. The proposed Directive has been extensively documented and amended to take into account the positions of authorities and organisations at both the EU and Member State levels[13].

It is intended that the Directive would contain provisions to take over the framework for control of pollution by dangerous substances under Directive 76/464/EEC (described above). As such, that Directive would be repealed as of 31 December 2007, except for Article 6 which would be repealed as of the entry into force of the new Directive.

The proposals envisage a 'combined approach' in that both EQSs and ELVs would be used in order to control emissions of dangerous substances to water (rather than allowing for a choice of mechanisms). The use of Best Available Technology (BAT) is to be required in the setting of ELVs.

As stated previously in this report, naphthalene is on the 1982 list of 129 chemicals to be considered as priorities for inclusion under List I of Directive 76/764/EEC[14]. It is now intended that this list be replaced with a new list of priority substances under the Water Framework Directive (WFD).

The Commission has initiated a new procedure for the prioritisation of chemicals in the field of water quality. This led to the development of the combined monitoring-based and modelling-based priority setting (COMMPS) procedure by the Fraunhofer Institute.

In February 2000, the Commission published a 'proposal for a European Parliament and Council Decision establishing the list of priority substances in the field of water policy' (COM (2000) 47 Final). This proposed list is reproduced as Annex II.

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13 COM (97) 49 final: Proposal for a Council Directive establishing a framework for Community Action in the field of water policy, Commission of the European Communities, 1997. Amended in 1997 by COM (97) 614 final and in 1998 by COM (1998) 76 final, the latter of which elaborates Annex V to the proposed Directive. The Council of the European Union reached a Common Position on the proposal on 22 October 1999 (OJ C 343, 30.11.1999, p1).

14 OJ C 176, 14.7.1982, p3.

Provisions will be developed in order to set emission limit values and also environmental quality standards for the substances (as opposed to a choice of measures which was the situation under Directive 76/646/EEC).

In this proposed priority list, naphthalene is indeed included. Although this priority list has yet to be formally agreed, the inclusion of naphthalene certainly provides a means by which emissions of this substance can be controlled. The WFD will apply where emissions occur to the environment (i.e. direct from installations and following WWTP). The WFD also incorporates baseline measures to be included in 'programmes of measures' which are intended to achieve the environmental objectives of Community water policy. These baseline measures include those under various other Directives in the sphere of water quality.

The following paragraph is taken from the proposed WFD:

> "For the substances on the priority list, the Commission shall submit Proposals for controls on the principal sources of the emissions concerned. In doing so it shall take account of both product sources and process sources and shall identify the cost-effective and proportionate combination of controls. Where appropriate, action at Community level for process controls may be established on a sector-by-sector basis.
>
> For process sources not controlled under Directive 96/61/EC, process controls shall be emission limit values or equivalent controls based on the Best Available Techniques. For installations controlled under Directive 96/61/EC, the Commission shall consider the need for further controls, including under Article 18 of that Directive."

The proposal also states (Article 13(3)(f)) that the basic measures should include a requirement for prior authorisation or general binding rules for all process discharges liable to contain significant quantities of any pollutant, in particular the priority substances (which may include naphthalene). The authorisation would lay down ELVs or equivalent controls for the pollutants concerned.

An important point is that the proposed Directive refers to the 'principal sources' of priority pollutants in the environment in terms of the controls to be used. Thus, on a site-specific level, a number of (if not all) sites using naphthalene in grinding wheel manufacture may not turn out to be principal sources. Controls required could, therefore, be applied on a basis which is proportional to the risk posed. In other words, those sites which do not pose unacceptable risks to the environment need not suffer any additional burdens in terms of emissions reduction.

4.3 Integrated Pollution Prevention and Control

Integrated Pollution Prevention and Control (IPPC) provides a basis for controlling emissions from certain industry sectors and pollution by certain polluting substances. Its

legal basis is provided for in Council Directive 96/61/EC which owes much to established regimes in Member States, particularly Integrated Pollution Control (IPC) in the UK.

The IPPC Directive "lays down measures designed to prevent or, where that is not practicable, to reduce emissions in the air, water and land" which arise from the industrial activities listed in Annex I to that Directive. Such industries will require a permit which specifies certain operating requirements which must be adhered to. These involve:

- application of best available techniques (BAT) to prevention;
- requirements that pollution is not caused;
- waste management involving avoidance, recovery or safe disposal (in that order);
- energy efficiency;
- accident prevention and limitation; and
- site remediation following cessation of activities where this is required.

Inclusion of emission limit values is an integral part of the IPPC regime. These may be set in excess of what is generally recommended in order to meet specific environmental quality standards (ELVs and EQSs were discussed in the previous section).

BAT, referred to above, is to be defined for each of the industrial activities which are covered by the Directive. This process will take place on an EU-wide basis and will involve the production of BAT Reference Documents ('BREF Notes') which will take into account the following (as set out in Annex IV to the Directive):

- the use of low-waste technology;
- the use of less hazardous substances;
- the furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate;
- comparable processes, facilities or methods of operation which have been tried with success on an industrial scale;
- technological advances and changes in scientific knowledge and understanding;
- the nature, effects and volume of the emissions concerned;
- the commissioning dates for new or existing installations;
- the length of time needed to introduce the best available technique;
- the consumption and nature of raw materials (including water) used in the process and their energy efficiency;
- the need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it;
- the need to prevent accidents and to minimise the consequences for the environment; and
- the information published by the Commission pursuant to Article 16(2) or by international organisations.

On a national level, similar documents will be published, usually in a corresponding order, under the relevant implementing legislation. For example, the UK's BREF document for the ceramics industry is due to be prepared in 2001[15].

The majority of processes covered are also qualified with threshold capacities, above which an IPPC licence must be obtained. The category which might apply to the use in question is:

> 3.5. Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain, with a production capacity exceeding 75 tonnes per day, and/or with a kiln capacity exceeding 4 m^3 and with a setting density per kiln exceeding 300 kg/m^3.[16]

This would appear to apply to the manufacture of grinding wheels since the process does involve "the manufacture of ceramic products by firing". However, the relevant information has not been developed as of yet (i.e. BREF notes). Thus, control through this mechanism would appear to be possible although it would be dependent upon the size of the installations in question. This is discussed in more detail in Section 5.

Section 3.4 of Annex 1 to the IPPC Directive refers to the "melting of mineral substances" which is not thought to incorporate the process in question because only the ceramic material undergoes melting (vitrification). In this context, it is understood that only the alumina used would be classified as a mineral substance and would thus not be covered by this section: alumina (corundum) has a melting temperature of 2050°C whereas glass forming silicates (such as those used to vitrify grinding wheels) have melting temperatures of around 900-1100°C[17].

For the ceramics industry, the DETR's Fourth Consultation Paper on implementation of the IPPC Directive estimates that seven installations will be covered as A1 processes and around 75 as A2 type processes[18].

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15 Draft Pollution Prevention and Control Regulations as set out in the DETR's Fourth Consultation Paper on the Implementation of the IPPC Directive, 18 August 1999.

16 Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control, Annex I.

17 Source: **Firing Ceramics**, G. Bickley Remmey Jr. World Scientific.

18 Under the UK's proposed regulations both A1 and A2 processes have the same requirements as those of the Directive. The distinction being that for an installation to be classified as A1, there is the requirement that "a reducing atmosphere is used other than for the purposes of colouration." Note that Part B processes do not have the same capacity requirements but are only subject to Local Air Pollution Control (LAPC).

4.4 Restrictions Upon Marketing and Use

Restrictions upon the marketing and use of a substance (i.e. naphthalene) can be introduced under Directive 76/769/EEC.[19] This Directive was adopted as a means to harmonise such restrictions throughout the EU and, as such, was adopted under Article 95 of the Treaty (Art. 100a prior to 1997 and Art. 100 prior to 1986).

Under the Directive, Member States must "take all necessary measures to ensure that the dangerous substances and preparations listed in the Annex may only be placed on the market or used subject to the conditions specified therein" (Article 2). The Annex in question has been amended several times to include additional substances and to alter the required conditions. Restrictions upon the use of naphthalene (e.g. for use in grinding wheel manufacture) could be introduced through such a ('daughter') Directive.

Since 1976, around 40 substances and preparations have had such restrictions imposed. The Directive has been seen as a primary means of implementing restrictions under the Existing Substances Regulation (see Article 11(3) of Regulation 793/93/EEC). Introduction of marketing and use restrictions is often a lengthy process due to the need for approval by both the Council and the Parliament.

Measures adopted in accordance with the Directive may include:

- outright bans upon the use of certain substances and preparations;
- bans upon the use of certain substances and preparations in certain products; or
- restrictions on the concentrations of dangerous substances in products.

Thus, consideration has been given in this study to the implications of a ban upon the use of naphthalene in grinding wheel manufacture.

Timetables must be drawn up for implementation of these measures. These may include provisions for phasing in restrictions over time or through a staggered coverage of sectors.

Restrictions upon marketing and use are suitable where the risks associated with the use, manufacture, etc. of products are very significant. The relative costs and benefits of the use of this instrument should be rigorously taken into account whenever it is considered to be the most appropriate measure because its implications for the industries involved may be considerable. The stages of a product's life-cycle at which major risks occur is another important factor when considering the appropriateness of this measure.

A further vital consideration is obviously the availability of alternatives when this measure is employed. Where there is no suitable alternative material or the only

[19] Council Directive 76/769/EEC of 27 July 1976 on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations.

available alternatives pose a potentially greater threat to the environment, the 'costs' associated with marketing and use restrictions may outweigh the benefits.

4.5 Industry Environmental Agreements

4.5.1 Recognised Agreements

This type of risk reduction measure potentially provides a very effective option. Recognised in the European Commission's Fifth Environmental Action Programme, these measures theoretically provide an approach to environmental protection which is pro-active and flexible rather than which is more reactive and prescriptive. They allow a greater input from industry in determining the methods for improving environmental protection.

Communication (COM(96) 561 Final) from the European Commission sets out guidelines for the use of environmental agreements as a means of implementing EC Directives at national level and for their use at Community level. Further to this, the Commission has made a formal Recommendation (96/733/EC) as to how Environmental Agreements should be used, which have been (in general) accepted by the Council of the European Union (Council Resolution 97/C 312/02).

Involving industry earlier in the process can help avoid the defensive position sometimes taken by industry to environmental regulation. It should also lead to greater cost-effectiveness since it should avoid the need for extensive prescriptive measures; the desired outcome may also be achieved in a shorter time-scale than would be achieved through regulation alone.

These agreements, however, will usually require some form of legislation in order to provide a failsafe against non-compliance, for example, by companies which 'free-ride' and allow other companies to introduce risk reduction measures whilst they themselves take no action. Fines or other penalties may provide an effective sanction against this; they may be enforced if the agreement is made legally binding. For the purposes of this study, Environmental Agreements are taken to include voluntary commitments undertaken by firms and/or industry sectors which are the result of negotiations with public authorities and/or explicitly recognised by such authorities (as described in the Commission's Communication and EEA, 1997). Codes of conduct and other controls are considered in a separate section.

In a European Environment Agency report on Environmental Agreements (EEA, 1997), the following criteria were suggested for the suitability of such agreements:

- pro-active industries or businesses;
- small number of partners or high organisation level of signatory partners;
- production of goods (i.e. industry);
- sectors which have matured and face limited competition (i.e. where there are few opportunities for 'free riders');

- environmental problems of limited scale (national and regional environmental problems);
- limited number of sources of pollution; and
- long-term targets.

The report also suggests certain factors which will make implementation more effective:

- setting of clear targets prior to the agreement;
- specification of a baseline against which to measure improvements within the agreement;
- reliable and clear monitoring mechanisms specified within the agreement;
- the availability of technical solutions to be used to reach the target;
- limited and similar costs to all parties of complying with the agreement; and
- involvement of third parties within the design and application of the agreement.

These are based largely upon COM(96) 561 Final. This communication also states that there are several guidelines for the use of environmental agreements; these are discussed below:

- they should allow for adequate consultation with all interested parties and should have a written contractual form which also allows for sanctions due to non-compliance. The agreement should also include a commitment by the public authority that legislative action would only be invoked should the agreement fail to work effectively;

- they should have *quantified objectives*: this is necessary to avoid the perception that agreements may be used purely to avoid or delay effective action. Targets should be expressed as percentages such as for reductions in emissions or as absolute figures such as maximum emissions;

- a *staged approach* should be used: a clearly defined timetable should be agreed which includes specific interim objectives. This allows parties to gauge effectiveness as the agreement develops and to vindicate their choice of instrument. These objectives may or may not include requirements for legislative action if it is found that they are ineffective, though regulatory/fiscal sanctions will generally be required in the event that overall conditions are not met;

- the agreement will require *monitoring*: this must be defined in the text of the agreement and should require that data collected are reliable and accurate in terms of completeness and comparability. Independent verification will likely be required;

- it should be *transparent*: agreements should be published publically and progress reported to the competent authority and also made public (e.g. through Directive 90/313/EEC on the freedom of access to information on the environment). Such transparency should aim to improve the perception of the agreement's

effectiveness as opposed to purely legislative actions and also the perception of the environmental credentials of the participants; and

- the agreement should be *compliant with other laws and agreements*: for example, it should be compatible with national and Community law as well as international agreements such as GATT.

Whether contracts detailing Environmental Agreements are subject to public or civil national law will have important implications for sanctions against breach of contract, liability, jurisdiction of the courts, etc.

Environmental Agreements must be passed by the Commission who will weigh restrictions on competition against the environmental objectives of the agreement. This is done by means of Article 36 of the Treaty which allows Member States to impose restrictions for the protection of health and life of humans, animals and plants (and the environment, as has been recognised by EC case law).

They should not create barriers to the effective functioning of the internal market and can only discriminate between products on the grounds of protection of human health or the environment. The measure must be the least restrictive possible; it must not be a means of arbitrary discrimination or disguised restriction on trade. The measure may also only be taken in the absence of other EC law in the area. This applies both to quantitative restrictions and "measures having equivalent effect".

4.5.2 Voluntary Industry Action

Outside the scope of 'Environmental Agreements' which should have some regulatory basis or recourse for non-compliance, action by industry alone may be one means of achieving the desired reductions in emissions.

For example, through recognition of the existence of risks to the environment associated with releases of naphthalene, the industry may decide to introduce the technologies required to reduce emissions. This might take the form of initiatives on the part of individual companies or measures coordinated by a trade association, for example.

Consultation has indicated that an organisation will be set up by the abrasive industry in Europe called the 'Organisation for Safe Abrasives' (oSa). It is envisaged that this organisation would be set up to look at safety issues associated with the end use of their products. However, similar initiatives might be set up which could address the emissions of naphthalene (perhaps confined to those manufacturers which use naphthalene).

Information programmes are recognised in the Technical Guidance Document as being one of the potential methods for implementing risk reduction measures. In this context, risk reduction measures could attempt to reduce emissions through direct steps taken by industry. Due to the apparent disparity in levels of emissions, dissemination of cleaner technologies would appear to be both an effective and an appropriate risk reduction measure. This would, therefore, include information on 'end-of-pipe' controls or

clean(er) technology; the latter of which might include requirements for the recovery and/or recycling of naphthalene from grinding wheel production facilities.

4.6 Control of Atmospheric Emissions at a Local or National Level

Since it has now been clarified that atmospheric emissions of naphthalene from grinding wheel manufacture do contribute significantly to soil concentrations (1%), this measure is removed from further consideration. Controls upon emissions to water are considered to be sufficient to ensure that no unacceptable risks are posed to the environment, without the need for additional controls upon atmospheric emissions.

This is not to say that atmospheric emissions of naphthalene are not a serious local issue in themselves. Historically, such emissions have been the cause of local nuisance problems. It should now be the case, however, that such emissions are unlikely to pose any risk and they are expected to be adequately regulated under local control.

5. ASSESSMENT OF RISK REDUCTION MEASURES

5.1 Introduction

It was evident upon the completion of a systematic qualitative assessment (Stage 2) that marketing and use restrictions (in the form of a ban) would not be an appropriate means to control the risks to the environment associated with manufacture of grinding wheels. As a result, a more detailed semi-quantitative study (Stage 3) has not been undertaken.

The approach adopted, therefore, has been to address the advantages and drawbacks of possible measures based mainly upon qualitative information as to their likely implications (with some cost data provided). Thus the *relative* magnitude of the advantages and drawbacks of different measures has been assessed as a basis for making recommendations. This assessment has taken into account the imminence and degree of risks involved (as described in Section 2.5)

In this section, the potential risk reduction measures which were detailed in Section 4 are considered in greater detail. As specified in the Technical Guidance and in the legislation, there are four key criteria which should be taken into account in undertaking an assessment of the advantages and drawbacks of risk reduction measures: effectiveness, practicality, economic impact and monitorability.

5.2 Restrictions Upon Marketing and Use

5.2.1 Scope

Restrictions upon the marketing and/or use of naphthalene form undoubtedly the most stringent means by which to control the risks associated with priority substances. A ban upon the use of naphthalene in grinding wheels would, once implemented, have the almost certain effect of reducing emissions from this sector to nil.

In this section, consideration has first of all been given to the availability of substitute chemicals which could be used if such a ban were to be implemented. This is intended to form the basis of a discussion of the advantages and drawbacks of such restrictions in terms of the four considerations required[20].

[20] The Marketing and Use Directive (76/769/EEC) provides a very flexible framework for the introduction of risk reduction measures. These need not, therefore, necessarily entail a blanket ban upon the use of naphthalene for grinding wheels. However, recognising that the implementation of such measures would require a significant amount of administration and thus time, only a potential ban is considered in the discussion of these restrictions.

5.2.2 Potential Substitution of Naphthalene

Consultation with industry has encompassed several manufacturers of vitrified grinding wheels which make their products using pore-inducing agents other than naphthalene. Several of these companies have stated that these are a suitable alternative and that use of naphthalene for this purpose is not required.

Nonetheless, those companies which actually do use naphthalene have indicated that extensive trials on potential substitutes, which include those used by the aforementioned companies, have been largely unsuccessful. This is due to the variability in product requirements amongst manufacturers (thus a substance which is suitable for one product may not be suitable for another).

Separate sub-sections have not been allocated to a discussion of each of the potential substitutes identified since a detailed assessment cannot be made on the basis of the information provided on testing by industry. However, the data provided have been used in order to eliminate some of these substitutes from further consideration.

Reasons for the Use of Naphthalene as a Pore-Former

The following information has largely been obtained from those companies manufacturing vitrified grinding wheels using naphthalene although some comes from companies or individuals having previous experience in this area.

Naphthalene is a plastic material but at the same time has a good resistance to pressure (and is thus suitable to its use in vitrified grinding wheels). Therefore, in the manufacture of these products, the desired shape can be formed by the application of pressure in order to dictate the size of pore spaces. The resistance to pressure enables the integrity of these pore spaces to be preserved and also allows for an even distribution of grits which helps to make the wheel efficient in use.

A key factor is the behaviour of the substance under various temperatures and pressures. At room temperature, naphthalene is relatively stable although some will evaporate even then. Despite having a boiling point of around 218°C, during the production of vitrified grinding wheels, it volatilises at a lower temperature due to the length of time which this process takes. When mixed with the other constituents of the product it is a solid, but evaporates when heated to only moderate temperatures (60-100°C). This leaves the product in a stable form with pore spaces having been created. Since the naphthalene retains its shape before evaporation, the size and shape of pore spaces can be accurately controlled.

The naphthalene is generally well removed from the product before the wheel is fired. However, this is necessarily often a lengthy process, i.e. evaporation may be required to occur over a relatively long time using relatively low temperatures in order that no cracks or channels occur as a result of its evaporation. This helps to retain the strength of the wheel allowing creation of the finished product through firing in much the same way as non-induced-pore products.

There are, however, several potential drawbacks with the use of naphthalene for this purpose. These are related to the environmental and human health impacts considered in the Risk Assessments. Since it evaporates to an extent at room temperature and is processed at higher temperatures where it volatilises further still, odour nuisances have historically been a feature of sites manufacturing grinding wheels using this method. This has been a particular problem due to the fact that such sites are generally situated in fairly heavily populated areas.

Although some companies do undertake recovery (for reprocessing) of naphthalene, this has generally been abandoned in favour of incineration. This is for several reasons: firstly, naphthalene is explosive above certain concentrations and recovery must, therefore, be undertaken carefully. Indeed, at least one company has abandoned the use of naphthalene due partly to its explosive properties[21].

Secondly, recovery is made more difficult by the fact that the naphthalene used is required to be pure and of uniform and set size. Naphthalene which is recovered will generally not fit these criteria, necessitating further processing in order to produce a suitable regenerated product. This is evidently not cost-effective and is likely to increase concerns over safety.

Substitute Pore-Forming Agents

As mentioned previously, there are several substances which can be used as artificial pore-forming agents in vitrified grinding wheels. Some of these are actually in use by the industry and some have simply been tested as possible alternatives.

Perhaps the most obvious substitute for naphthalene is 1,4-dichlorobenzene[22], a substance which has very similar properties to naphthalene. Around 100 tonnes of this substance are used in the EU for the manufacture of grinding wheels each year. This is against a total of 14,500 tonnes used each year.

Consultation has indicated that, in terms of performance, this substance has been shown to be the most suitable alternative to naphthalene for the use in question. Fewer process changes would be required than for many of the other alternatives which have been suggested. Note that, despite some companies having been able to use substitute pore-formers, this does not necessarily indicate that all products can be made using one of those substances (as discussed below).

However, it is widely thought in the industry that the health and environmental effects of 1,4-dichlorobenzene may be equal to or greater than those associated with naphthalene.

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[21] Condensation of naphthalene upon cold surfaces such as in pipes can cause a build-up and subsequent blocking which may provoke an explosion.

[22] This substance is commonly referred to as para-dichlorobenzene (pdb), a terminology which was used in the Stage 2 report but is replaced here with the IUPAC name of 1,4-dichlorobenzene.

Therefore, despite having been found to be a suitable alternative in some trials, widespread use has not commenced due to those health and environmental effects.

1,4-dichlorobenzene is itself a priority substance for risk assessment under Directive 793/93/EEC with France acting as rapporteur (INERIS/INRS, 1999). A summary of the physical properties and some of the Risk Assessment findings is given in Annex III. These are compared with those for naphthalene.

In terms of risks to the environment, 1,4-dichlorobenzene would appear to be preferable to naphthalene since all of the PNEC values have been calculated to be lower for this substance. However, the human health risk assessment for this substance has concluded the following:

> "Workers: (iii) There is a need for limiting the risks:
>
> Taking into account the currently available toxicological data and the estimated occupational exposure, this conclusion (iii) is reached because:
>
> - nasal and ocular irritation due to vapour exposure during use for formulation and production of grinding wheels
>
> - repeated dose toxicity, thereby possibly induced carcinogenicity and reproductive toxicity due to exposure mainly via inhalation, during manufacture and use (intermediate, formulation and production of grinding wheels)."

It was considered that there is no need for risk reduction measures beyond those which are already in place or for further information/testing in the case of risks to the environment and to consumers. Risk reduction measures have not yet been agreed for this substance but, due to the nature of the risks, will focus upon workers only.

In terms of other substitute pore forming agents, a number of plant-derived products have been tested by several companies. These include crushed nuts and nut shells, wood chippings, rice and olive stones. These substances have been adopted by some companies for use in grinding wheel manufacture. However, this should not be seen as an indication that all naphthalene used for this purpose could be similarly substituted. The grinding wheel products vary in terms of their properties (such as hardness, size of grits and porosity) and their intended use. This has the effect of making plant-derived substitutes unsuitable for certain applications.

Advantages with the use of such (plant-derived) products include the fact that they are likely to have relatively minor associated environmental impacts. They are also inexpensive in comparison to naphthalene. The disadvantages are primarily related to the production process though there are implications for the finished product. Wood, for example, will absorb water and will thus compromise the consistency of pores formed in the finished products. These alternatives may also swell during processing and thus render the product unviable.

Another disadvantage with the use of plant-derived products is the difficulty in obtaining the uniform particle size which is provided by naphthalene. These substances will generally not be removed to any great extent during the drying process and will thus remain until the firing stage. Even then, residues may remain in the products which will be considered unacceptable. This also places limitations upon the amounts of these substances which can be used since, when burnt, the residual ashes (mainly carbon) become absorbed by the ceramic bond, forming a so-called 'black core'.

Plastics, as with crushed nuts, (further substitutes which have been tested) burn when fired. The associated heat and gases can cause cracking in the structure of the product which makes it unacceptable for use. Although no detailed information has been made available, this situation is likely to be similar for the use of wax beads.

Bubbled alumina and glass spheres have also been suggested as potential alternatives. Alumina bubbles can be formed by blowing it through a furnace. This method, as with the use of glass spheres, allows the size of cavities to be determined and for that size to be relatively uniform.

These substances remain within the finished abrasive product (as compared to naphthalene which is completely removed). Some companies have indicated that the use of these products does not interfere with the effectiveness of the final product. However, others have suggested that their use in grinding wheels used in machining soft materials makes the wheel unsuitable.

On balance, it would appear that suitable substitute pore-formers exist for *some* types of grinding wheels. However, naphthalene is used in the production of abrasives having technical specifications which could not readily be matched if an alternative to naphthalene were to be used. The alternatives discussed above would generally not provide the same flexibility in terms of product structure.

5.2.3 Advantages and Drawbacks of Marketing and Use Restrictions

In accordance with the Technical Guidance and for the sake of consistency, restrictions upon marketing and/or use have been considered under the headings of the four criteria which should be taken into account (effectiveness, practicality, economic impact and monitorability). This approach has also been adopted in considering the other potential risk reduction measures.

Effectiveness

Restrictions under Directive 76/769/EEC would have virtually certain effects: if a ban were implemented, use of naphthalene for abrasives manufacture would not be allowed and could, therefore be assumed to be non-existent.

Such a measure would have the effect of eliminating the environmental risks associated with the use of naphthalene. Although, as mentioned previously, this would not combat high environmental naphthalene concentrations which are associated with naphthalene

formed as a by-product of other processes, notably combustion processes. There are high levels of naphthalene in the environment which cannot be addressed through risk assessment and risk reduction under Regulation 793/93/EEC.

As discussed above, many alternatives would likely have lower associated environmental impacts. However, it should be emphasised that naphthalene can and is currently used in the application in question without causing any unacceptable risks to the environment. The issue of substitutes might, therefore, be considered somewhat peripheral since to impose a ban upon all users where only some (and possibly none) cause unacceptable risks to the environment would be inequitable.

The only substitute which would come closest to meeting the product requirements of the grinding wheels in question is 1,4-dichlorobenzene. Since unacceptable risks have also been identified in the manufacture of grinding wheels for this substance, it should not be recommended as a substitute. However, for both naphthalene and 1,4-dichlorobenzene, grinding wheels can be - and are - manufactured without posing any unacceptable risks to either human health or the environment. Evidence for this is provided by the fact that the risks identified relate to certain sites (under worst-case emissions scenarios and using historical data).

Practicality

Use of naphthalene in manufacture of grinding wheels is relatively minimal within the EU (350 tpa as compared to total naphthalene use of around 150,000 tpa). There are just a few manufacturers producing abrasives which require the certain performance characteristics which naphthalene is used to obtain. Introduction of an EU-wide ban would, therefore, be theoretically relatively simple to implement.

However, the nature of the industry actually makes the introduction of marketing and use restrictions relatively *impractical*. The process required in order for such a restriction to be passed is very lengthy and may be considered an improper use of resources.

Marketing and use restrictions (in the form of a ban) are generally only recommendable where the risks associated with the use of a substance are very significant indeed. This is not the case with naphthalene since only a relatively small proportion of total production has been identified as posing risks to the environment and these risks are being addressed by grinding wheel manufacturers. In addition, environmental concentrations associated with naphthalene used for this purpose are lower than those from other sources, such as combustion processes.

In considering practicality, it is essential to consider what the effects of a ban would be in terms of the substitution of naphthalene with alternative substances. In relation to the discussion of alternatives provided above, consultation has indicated that substitution with alternatives has not proven possible for many of the grinding wheel manufacturers due to the technical requirements of their products. Indications that other companies are using substances which have been rejected by others should not immediately be taken as reluctancy to move away from naphthalene since suitability will be determined mainly

by the nature of the finished product which can vary according to intended applications and associated performance requirements. As discussed below, some companies would apparently not be able to use a substitute and would thus be unlikely to be able to continue production.

Although 1,4-dichlorobenzene can and is used as a substitute for naphthalene in the manufacture of grinding wheels, unacceptable risks have also been identified for this process. Considering the fact that companies have proven that naphthalene can be used without unacceptable risks, it would seem impractical to impose a ban upon use of naphthalene for this process in favour of 1,4-dichlorobenzene.

Economic Impact

For those companies which use naphthalene in manufacture of grinding wheels, the economic impacts of marketing and use restrictions (a ban upon the use of naphthalene in grinding wheel manufacture) are likely to be very significant.

The products in question often account for a significant proportion of sales and production volumes. A ban on the use of naphthalene would therefore affect a significant amount of their business. For example, one company has indicated that a ban upon the use of naphthalene for grinding wheel manufacture would result in the loss of around one third of their product lines (since these could not be produced with an alternative pore-former). There would thus be not only losses in profits but also job losses, etc.

Several of the substitutes considered would be significantly cheaper to purchase than naphthalene. This would be particularly obvious in the case of, for example, wood chippings. However, the pore-forming agent accounts for a relatively small amount of total production costs.

In addition, the economic impacts on regulators would be comparatively high. As mentioned previously, marketing and use restrictions are often complicated and time consuming to implement. Considering the scale of the problem, a ban on the use of naphthalene in grinding wheels is not thought to be a cost-effective means of control. There is only a small number of companies using naphthalene in the EU for this purpose and by no means all have high associated environmental risks. However, despite measures having been taken by the industry to significantly reduce emissions, some form of risk reduction measure will be required in order that these levels of emissions do not occur in new sites established for this use of naphthalene (as well as targeting any sites which have not been accounted for).

If manufacture of these products were to be prohibited where use of naphthalene is concerned, production would likely be shifted to outside the EU to locations where use of naphthalene is still allowed.

The economic impacts would appear to be particularly harsh considering the nature of the risks arising from the use of naphthalene for this purpose. All of the companies that have been contacted have now demonstrated that environmental risks can be adequately

controlled through other means. It would, therefore, be unjustifiable to prevent use of this substance when its associated environmental impacts can be adequately controlled through the reduction of emissions.

Monitorability

Restrictions upon marketing and use are particularly simple to monitor. A ban upon the use of naphthalene could be imposed upon suppliers and potential users.

In comparison to measures such as IPPC or limit values/EQSs, the resources required for monitoring would likely be minimal.

5.2.4 Conclusions on Marketing and Use Restrictions

Based upon the information above, it has been concluded that the costs of introducing marketing and use restrictions would almost certainly not be outweighed by the benefits of a reduction in risks. This is largely for the following reasons:

- there do not appear to be any suitable substitutes which can match the performance of naphthalene which also are likely to have lower environmental and/or human health impacts;
- there exists a majority of manufacturers for whom environmental risks are within acceptable levels (expected to be all of the companies identified in the study within a few years). As such, further restrictions at these sites are not necessary; and
- the economic impacts of further restrictions would probably be very significant, leading to a large number of job losses and closure of some companies.

5.3 Integrated Pollution Prevention and Control

5.3.1 Background

In Section 4, a description of integrated pollution prevention and control (IPPC) was given. As mentioned in Section 4, the manufacture of grinding wheels could potentially be controlled by this means. This would likely be either under the category of installations for the manufacture of ceramic products by firing for which production capacity must exceed 75 tonnes per day, and/or kiln capacity must exceed 4m^3. In relation to the industry in question, the former figure is unlikely to apply since, by extrapolating from the amounts of naphthalene used as a percentage of the grinding wheels produced (and verified through consultation), production volumes are generally much lower than 75 tonnes per day. However, the latter figure might well apply since this is thought to be a relatively small kiln size.

During Stage 2 of this study, it was unclear as to whether the IPPC regime would apply to the industry in question. Since then, information provided by the Environment Agency (for England and Wales) has indicated that the abrasive manufacturing processes in question will probably not be regulated under IPPC.

A discussion is given here as to the advantages and drawbacks of the use of this measure in the case that IPPC would apply. This discussion is provided in order to indicate whether, if this approach were to prove to be by far the most appropriate option, recommendations should be made for the inclusion of grinding wheel manufacturing sites under the IPPC regime.

5.3.2 Advantages and Drawbacks of Integrated Pollution Prevention and Control

Effectiveness

In theory, IPPC would provide a relatively effective means for the control of emissions of naphthalene from the industry in question. It would allow limit values to be placed upon emissions which would be tailored to reduce the risks to levels which are acceptable.

IPPC would address risks to all environmental media. However, it is evident from the preceding discussion that risks to the environment can be addressed through reducing emissions to water alone (which would include sediment, WWTP and sewage sludge). This is not to say that atmospheric emissions do not require control but that the sites which have been examined in the Risk Assessment and in this study have implemented (or are in the process of implementing) measures which will reduce the emissions to acceptable levels. Even in the worst-case scenario used in the Risk Assessment, emissions to atmosphere accounted for only 1% of risks (applying to the terrestrial environment only).

There are requirements upon the size which an installation must be in order to be controlled by IPPC. Of those companies involved in the consultation exercise, the maximum amount of naphthalene used at a site has been indicated as 100 tonnes per annum. Assuming a concentration in grinding wheels of 15% (and no recycling of naphthalene), this would involve production of 667 tpa of this type of wheel (before naphthalene is driven off). This is equal to only around 2 tonnes per day, far less than the 75 tonnes per day which is one criterion for inclusion under IPPC. In terms of the other criterion for inclusion, most sites would be expected to have a kiln size greater than $4m^3$ and could thus, *theoretically*, be controlled.

Since Stage 2 of this study, it has become evident that IPPC will almost certainly not apply to the process in question. The manufacture of grinding wheels is a relatively small process as compared to the abrasives processes which will likely be the focus under the IPPC regime.

However, at some sites, production of various other abrasives products is likely to occur. Since these may fall under the above categories defined in the IPPC Directive (e.g.

melting of silicon carbide (carborundum)), the sites as a whole may become controllable by IPPC[23]. Nevertheless, it is likely that a significant number of the sites in question, if not all of them, would still fall outside the scope of control by IPPC.

Practicality

The sector under consideration is, in the context of the use of naphthalene as a whole, a relatively minor one. It also involves a relatively small number of companies which are dispersed across the EU.

At a practical level, use of IPPC to control naphthalene releases from grinding wheel manufacture would require setting up requirements for BAT and for emission limit values and then administering them as part of the IPPC licensing process. This may prove particularly impractical for sites which require no other controls under IPPC than that associated with naphthalene emissions (for those sites which will actually be covered).

Consultation has demonstrated reductions in emissions across all of the companies which have provided responses. These reductions have been implemented largely as a result of pressure at a local level from the public and regulators[24]. Therefore, it would appear that reductions in emissions can be achieved at a cost which is not incommensurate with the achievement of a reduction in associated risks. Therefore, as part of an IPPC programme, there should be relatively few problems in developing standards for what constitute the best available techniques (BAT) for achieving acceptable levels of emissions.

However, the risks associated with the use of naphthalene in manufacture of grinding wheels are relatively minor as compared to those which can occur from most of the other processes which are covered by the IPPC Directive. It would, therefore, be questionable as to whether the resources which would need to be devoted to addressing this particular issue would provide significant benefit.

Therefore, the primary concerns as regards the practicality of the use of IPPC to address the risks are:

- whether in fact the process concerned (use of naphthalene in the manufacture of grinding wheels) would be covered by the Directive. It is evident now that it almost certainly will not; and

[23] The Directive states that "Where one operator carries out several activities falling under the same subheading in the same installation or on the same site, the capacities of such activities are added together."

[24] Several indications have been received which have stated that use of naphthalene has historically reached some notoriety in terms of the odour generated in the vicinity of these abrasives manufacturers. This is a particularly pertinent nuisance since these sites are frequently sited in densely populated areas.

- whether, in development of BAT for the abrasives industry emissions of naphthalene would be given sufficient priority to ensure suitable control (since other potential environmental impacts will have greater environmental impacts).

Economic Impact

Those sites which have invested in reducing emissions would be unlikely to require further investment. IPPC licensing would have the effect of bringing all current sites in line in terms of emissions control. In particular, it would ensure that any sites which have not undertaken emissions reduction would be adequately controlled.

If such processes will be controlled under the legislation irrespective of naphthalene emissions, the integration of additional requirements which take into account the potential risks identified in the Risk Assessment would likely be relatively inexpensive.

However, there are two principal reasons why the use of IPPC may not be a particularly cost-effective means of controlling the risks of concern:

1. As discussed in previous sections, highly elevated concentrations of naphthalene in the environment are not only associated with use in grinding wheels; they are also associated with various combustion sources (which are not under consideration for control in this study). IPPC may be expensive to set up and to administer given this need to account for background concentrations in setting environmental quality objectives. Also, resultant reductions in environmental concentrations may not be significant within this context, i.e. the risks local to grinding wheel manufacture could be addressed but other areas could not.

2. As mentioned above, total sectoral coverage is unlikely to be achieved due to the requirements for the size of manufacturing plant. IPPC would, therefore, be cost-effective in reducing emissions local to those sites which are controlled but not for the remaining sites.

Monitorability

By its very nature, IPPC requires that emissions of controlled substances are monitored. This should be done both in terms of absolute emission limits and in terms of meeting environmental quality objectives. Thus, for those sites which would be under control, compliance with this risk reduction measure could be relatively easily monitored.

However, monitoring effects upon environmental concentrations would likely prove to be a difficult task: sources of naphthalene other than the site itself will vary between localities. Any reductions in environmental concentrations observed in the environment might not, therefore, be the result of emissions reductions in the sector of concern. Likewise, where emissions have been reduced significantly, the effects upon the environment may not be recognised if emissions from other nearby sources (particularly combustion) increase.

5.3.3 Conclusions on Integrated Pollution Prevention and Control

Use of IPPC to reduce the emission of naphthalene would, in theory, appear to be an acceptable means of reducing the risks. However, it may not achieve full sectoral coverage and so might not affect all emissions. In fact, it may well be the case that none of the sites in question are covered. It may be the case that the highest emissions occur at installations which do not fall into this category, making the measure ineffective.

Regulation of naphthalene emissions should, however, be a part of the permit/licence required under IPPC for any installations which do indeed fall within the remit of IPPC. This could be integrated with any other reduction measures which are adopted (and indeed would be under the proposed Water Framework Directive).

5.4 Environmental Quality Standards and/or Emission Limit Values

5.4.1 Background

As described in Section 4, it is at present not completely clear how environmental quality standards (EQSs) and emission limit values (ELVs) could be applied to emissions of naphthalene under the impending Water Framework Directive. At the time of writing, the European Parliament and Council of Ministers are debating the most recent proposals.

Considering the fact that emissions to water are responsible for the vast majority of the risks (with atmospheric emissions contributing only 1% to terrestrial concentrations), limiting the emissions of naphthalene to water from grinding wheel manufacture through emission limit values would appear to provide a suitable means of reducing the risks.

It is technically possible to control emissions of naphthalene in the manufacture of grinding wheels, as evidenced by the findings of the Risk Assessment[25] and consultation for this study. Therefore, some form of standard emissions limit would appear to be the most equitable and practicable method of ensuring that no unacceptable risks occur from this type of process *both now and in the future*.

Since naphthalene is on the most recent proposal for inclusion as a priority substance under the WFD, a means is provided for control under the proposed new regime.

5.4.2 Advantages and Drawbacks of ELVs/EQSs

Effectiveness

A limitation on the emissions from grinding wheel manufacturers through a uniform water quality emissions limit value and/or through specification of EQSs should enable the associated risks to be adequately controlled. These could be set in order to ensure that

[25] Unacceptable risks were identified at just one of three sites. Risks associated with another site were found to be within acceptable levels.

levels in the environment are below those which will cause the PEC/PNEC ratio to rise above 1.

As mentioned previously, there exist anthropogenic (and natural) sources of naphthalene in the environment which can not be controlled under the aegis of the Existing Substances Regulation. Specifically, in the combustion of fuels such as coal, petrol, etc. (vehicle exhausts are the main source in the environment), naphthalene is a by-product rather than a commercial substance. Thus, although reductions in emissions from grinding wheel manufacture may be achieved through limit values, the reductions may not be sufficient to reduce environmental concentrations to acceptable levels.

For example, in an area where a producer of grinding wheels is located close to several combustion sources, reducing emissions from the grinding wheel manufacturer to a uniform level may not significantly reduce cumulative risks.

This strategy, however, is concerned only with addressing the risks arising from the manufacture of grinding wheels. Ensuring that the emissions from this type of site do not compromise the achievement of water quality standards would be effective in reducing the local risks which can be associated with this process and will help to contribute to the overall goals of the EU's policy on water quality.

The WFD would only provide a means of addressing risks to the aquatic environment (including sediment). It would not address the risks to microorganisms in WWTP or to the terrestrial environment through application of sewage sludge (except where naphthalene passes indirectly from either WWTP or fields into water courses).

The proposed amendment to the 1986 Directive on sludge (86/278/EEC) would, however, provide an appropriate means for addressing the levels of naphthalene in sewage sludge applied to land. These proposals contain maximum allowable concentrations for the content of polycyclic aromatic hydrocarbons (PAH) in sewage sludge applied to agricultural land, under which category naphthalene in sewage sludge could be controlled.

Practicality

Under the proposed Water Framework Directive, ELVs would be set at a level which reflects the Best Available Techniques (BAT). This would apply to those sites not covered by the IPPC Directive, which appears likely to be the case for the sites in question. Such ELVs would be set centrally for the specific industry and so would appear to be relatively easily implementable.

It should again be noted here that the environmental concentrations of naphthalene which are associated with manufacture of grinding wheels are significantly lower than those which can occur though other industrial activities, particularly combustion processes. However, those types of process are not considered under the ESR risk assessment process, as indicated in a previous section.

ELVs should be set at a level which is equal across all manufacturers of grinding wheels. This will ensure that, where there are additional sources of naphthalene in the environment, grinding wheel manufacturers will not be unfairly discriminated against in terms of their required emissions reductions. Indeed, the process envisaged under the Water Framework Directive would involve central setting of ELVs (except in cases where water has a status "below good" and additional measures are required by Member States).

Economic Impact

Taking into account emissions generated by the sites which have been identified, it is evident that emissions can be reduced at costs which are commensurate with the benefits of those emissions reductions. All of the companies contacted have invoked some form of risk reduction measure which has necessarily entailed costs to those companies. Benefits to the industry include better public relations and associated business impacts; also increased protection of the workforce.

Some companies have indicated the investment made in reducing emissions. The maximum value for this is Euro 1 million though all indications received were of a similar magnitude. Assuming that there are four sites across the EU which use naphthalene in grinding wheel manufacture, it could be inferred that the costs to industry so far have been around Euro 4 million. These costs have already been borne (although some of the investment was related to improvements other than emissions reduction). As this expenditure has already been made or is underway, the additional costs of technology in meeting emission limit values under the proposed Water Framework Directive would appear be nil to all the companies identified by both the Risk Assessment and this strategy.

There would be monitoring costs associated with ensuring that emissions are kept within the agreed limit. However, since ELVs would be required under the proposed WFD in any case, no *additional* costs would be introduced through reliance upon this measure to control the risks.

Costs of reducing emissions of naphthalene through control technology would probably be passed on to some extent to the consumer. However, since companies have already invested in emissions control technology (the effects of which are already or will be in the near future), it is not anticipated that consumers would incur any additional costs through the implementation of this measure.

Monitorability

As mentioned previously, due to site specific differences in emissions of naphthalene from other sources, attribution of the contribution of grinding wheel manufacture to environmental concentrations may prove problematic. However, if these ELVs are set at a uniform value at the point where waste waters leave the site, this will not pose any problem.

5.4.3 Conclusions on ELVs/EQSs

The risks (actual and potential) of naphthalene emissions from the manufacture of grinding wheels could be adequately controlled through setting ELVs for naphthalene in waste water leaving the sites in question. This would address the risks to the aquatic environment (including sediment).

If these levels are sufficiently reduced, the concurrent concentrations in WWTP and sewage sludge could also be reduced such that no risks are posed either to microorganisms in WWTP or to the terrestrial environment.

A suitable mechanism exists for such emissions reductions to be achieved in the proposed Water Framework Directive and the proposed list of priority substances (which includes naphthalene). Thus, the only additional requirements for control by this means would be that naphthalene concentrations in WWTP and sewage sludge are taken into account in setting ELVs for the sites in question.

Emissions to sewer would not be under the specific control of the Water Framework Directive (except with regard to their discharge from WWTP to the aquatic environment). Thus, it will be important that sludge arisings from WWTP are adequately controlled through the proposed amendment to the directive on sludge.

Since there will be a requirement for the development of standardised EQSs and ELVs under the proposed Water Framework Directive, there will be no additional costs imposed through using this as a means to control the associated risks.

5.5 Industry Environmental Agreements

5.5.1 Background

As detailed in Section 4, the types of instrument concerned herein are those which have specific recognition by the authorities.

The desired effect of an industry environmental agreement would be to achieve reductions in emissions to the environment without imposing disproportionate costs upon the industry concerned. In terms of achieving these reductions, such an agreement could be set out by specifying one or more of the following:

- use of 'end-of-pipe' controls to reduce emissions of naphthalene to water and to the atmosphere;
- requirements to use (or not to use) certain technologies in the production of grinding wheels; or

- requirements for recycling of naphthalene following use as a pore-forming agent (which some companies appear to believe is not possible but has been implemented by others).

These are all essentially linked to the requirement of ensuring that emissions are kept below certain levels but also could ensure continual improvement in emissions abatement technology.

5.5.2 Advantages and Drawbacks of Environmental Agreements

Effectiveness

Theoretically, an environmental agreement would have the effect of allowing the industry to achieve the desired reductions in emissions in a manner which is best suited to individual companies' circumstances. It could also promote innovation on the part of that industry in terms of the development of new technologies.

There exists a good network of trade associations at EU and Member State level through which such an agreement could be formalised (obviously in conjunction with the regulators). Additionally, consultation has indicated that proposals have been made for an EU-wide organisation titled 'Organisation for Safe Abrasives' to raise awareness of safety issues amongst abrasives manufacturers and to solve technical demands, including those from government. This was discussed in Section 4.

However, this proposed association is intended only to look at safety issues relating to finished products. Given the reported difficulties in its establishment, inclusion of additional requirements for restricting naphthalene emissions would likely make this an impractical tool for the foreseeable future.

Practicality

There are several reasons why environmental agreements (generally voluntary agreements) tend not to work in practice. Firstly, since the agreement is voluntary, some companies inevitably decide not to participate in the agreement and, therefore, reductions in risks will not be achieved at their sites. Also, these agreements can be seen as a reason for inaction or delay in the introduction of risk reduction measures: if the agreement is insufficiently transparent or does not have clearly defined objectives, the required reductions in risks may not be achieved.

Consultation has indicated that co-operation between European abrasives manufacturers is often poor. This would appear to make the introduction of an environmental agreement appear problematic.

Consultation has also indicated that the EU industry tends to adopt a reactive (as opposed to proactive) response when faced with potential imposition of restrictions upon their processes. Thus, an environmental agreement would appear to be relatively impractical.

Cost Effectiveness

It has been stated that environmental agreements have the potential to be a particularly cost-effective means of achieving desired reductions in risks. They may avoid the need for extensive prescriptive measures and may also be achieved in a shorter time-scale than regulation alone.

Indeed, it would appear that such a measure - if an effective one could be implemented - would have lower associated costs than most of the other measures considered. Costs could be expected to be lower both to the industry and also to the regulators. The latter would achieve cost-savings through negation of the need for development of extensive regulation and also through relatively low costs of monitoring.

Monitorability

It should be an essential requirement of any environmental agreement that strict guidelines are put into place for collection of monitoring data and its reporting to the authorities. However, in practice this is rarely achieved and these agreements are frequently criticised in this respect.

Monitoring of reductions in emissions would generally be undertaken by the industry themselves, although this should be supplemented with auditing by the authorities or by independent bodies.

Overall, the monitorability of such an agreement will be largely determined by the willingness on the part of industry to collect and to pass on data.

5.5.3 Conclusions on Industry Environmental Agreements

This would initially appear to be an attractive means of controlling the risks associated with use of naphthalene in the manufacture of grinding wheels. Risk issues relate to only a few companies (although there exists the potential for further companies to begin use of this process) and good sectoral coverage would, therefore, appear relatively easy to obtain.

However, given the reported poor co-operation within the industry and also its reported tendency to adopt a reactive approach to pressures upon issues such as this, the measure would appear to be unsuitable for the matter in hand.

In terms of the reliability of voluntary industry action (i.e. that which has no regulatory foundation), this would appear to have still less certain results than those which are formally recognised. Reliance upon such action would, therefore, appear to be insufficient, especially for any new installations.

5.6 Control of Atmospheric Emissions at a Local or National Level

Since it has now been clarified that atmospheric emissions of naphthalene from grinding wheel manufacture do contribute significantly to soil concentrations (1%), this measure is removed from further consideration. Controls upon emissions to water are considered to be sufficient to ensure that no unacceptable risks are posed to the environment, without the need for additional controls upon atmospheric emissions.

This is not to say that atmospheric emissions of naphthalene are not a serious local issue in themselves. Historically, such emissions have been the cause of local nuisance problems. It should now be the case, however, that such emissions are unlikely to pose any risk and they are expected to be adequately regulated under local control.

5.7 Summary Comparison of Potential Risk Reduction Measures

Table 5.2 provides a qualitative comparison of the relative impacts of each of the potential risk reduction options under the headings of the four decision criteria. This is intended to provide an aid to overall understanding of the findings of the assessment of options and to illustrate the basis for the recommendations made in Section 6.

Table 5.3: Qualitative Comparison of Impacts of Possible Risk Reduction Measures

	Effectiveness	**Practicality**	**Econ. Impact**	**Monitorability**
Marketing & Use	+++	-	---	++
IPPC	0	+	-	++
EQS/ELV	++	++	0 or -	++
Vol. Agreement	+ or 0	0	--	+

Key: +++ large positive impact, ++ moderate positive, + slight positive, 0 neutral, - slight negative, -- moderate negative, --- large negative

Table 5.3 provides a summary of the assessment of possible risk reduction measures against the four decision criteria of effectiveness, practicality, economic impact and monitorability. The discussion above, as summarised in Table 5.2, has been used to develop the conclusions and recommendations detailed in Section 6.

Table 5.3: Performance of Potential Risk Reduction Measures Against Decision Criteria				
Option	**Effectiveness**	**Practicality**	**Economic Impact**	**Monitorability**
Marketing and Use Restrictions	**Instrument**: amendment to Directive 76/769/EEC **Timing**: dependent upon agreement. Minimum 1 year **Coverage**: could cover all grinding wheel manufacturers **Level of Risk Reduction**: eliminates risks from grinding wheel manufacture but not other sources **Potential for Increased Risks**: dependent upon substitute. Most technically suitable also has risks in grinding wheel manufacture	**Achievability**: relatively straightforward to implement for regulator. Substitutes will likely pose problems in product and process changes **Flexibility**: inflexible since will require phase-out of naphthalene use in grinding wheel manufacture	**Industry**: potentially very significant effects due to inability to produce desired product using substitute (reduced profits, job losses) **Regulators**: high due to small nature of market Overall, costs likely to be incommensurate with benefits of reduced risks	Relatively low requirement for monitorability (just assurance that naphthalene not used for the purpose in question). Monitorability is, therefore, relatively easy.
IPPC	**Instrument**: Directive 96/61/EC **Timing**: 2001 earliest, 2007 latest **Coverage**: only installations above certain capacity. Latest information suggests will not apply to the use in question. **Level of Risk Reduction**: will address emissions to water but this may not be a priority. Pollution only minimised rather than eliminated **Potential for Increased Risks**: unlikely since requires emission reduction and does not require substitution	**Achievability**: emission limit values could be set on a site specific basis but other naphthalene sources in environment would likely complicate setting of quality standards **Flexibility**: companies allowed to choose means of compliance provided BAT used and emissions limits met	**Industry**: relatively low if otherwise covered by Directive; high additional costs if not otherwise covered **Regulators**: relatively high due to requirement to specify limit values and BAT taking naphthalene into account Overall, would be worthwhile if companies will be covered in any case (due to other aspects of their processes) but if not then very cost-ineffective (if this process could be added to those to be considered)	Should comprise part of general monitoring activity for IPPC installations Ability to monitor effects on environmental concentrations limited

Table 5.3: Performance of Potential Risk Reduction Measures Against Decision Criteria				
Option	**Effectiveness**	**Practicality**	**Economic Impact**	**Monitorability**
ELVs/EQSs for Water	**Instrument**: proposed Water Framework Directive **Timing**: already nationally set measures under 76/464/EEC. Water Framework Directive expected 2007 **Coverage**: all installations provided they are 'principal sources' of priority substance emissions **Level of Risk Reduction**: will reduce risks to adequate levels provided ELVs are correctly set (though will not tackle sources of naphthalene outside coverage of ESR) **Potential for Increased Risks**: unlikely since requires emission reduction and does not require substitution	**Achievability**: ELVs relatively simple to set (and ability to reduce emissions demonstrated by industry) **Flexibility**: operators able to choose means of compliance (will be based on BAT for processes outside IPPC)	**Industry**: Consultation indicates achievable in cost terms if technology-based for site alone. Costs mainly already borne as demonstrated by industry (emissions reduction programmes have cost ca. Euro 1 million per site in recent years) **Regulators**: Overall, technology-based ELVs cost-effective and will require only development of only one ELV (will be standard, except possibly in cases where water quality is below good) **Consumers**: Costs to consumers (through increased costs of final product) assumed to already have been borne since investment in emissions reduction already undertaken	Hard to monitor effectiveness due to high environmental concentrations from Relatively easy to monitor end-of-pipe ELV

Table 5.3: Performance of Potential Risk Reduction Measures Against Decision Criteria				
Option	**Effectiveness**	**Practicality**	**Economic Impact**	**Monitorability**
Environmental Agreements or Voluntary Agreements	**Instrument**: Either Recommendation 96/733/EC and Resolution 97/C 312/02 or purely voluntary **Timing**: quicker than marketing and use **Coverage**: dependent upon participants **Level of Risk Reduction**: dependent upon participants **Potential for Increased Risks**: dependent upon substitute. Most suitable in technical terms (pdb) may give increased risks	**Achievability**: unlikely to get full industry support **Flexibility**: inflexible since requirement for use of substitutes for naphthalene in grinding wheel manufacture	**Industry**: potentially very significant effects due to inability to produce desired product using substitute (reduced profits, job losses) **Regulators**: relatively low although legislative back-up may be costly Overall costs likely to be incommensurate with benefits due to anticipated poor participation and high costs of substitution compared with level of risk reduction achieved	Monitoring should be an essential component of an environmental agreement. May be difficult to ensure full sectoral coverage and will be dependent upon willingness of industry to pass on data

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based upon the assessment of potential risk reduction measures in Section 5 and the nature of the risks (as described in Section 2), the following requirements exist for the choice of the most appropriate measure:

1. It should adequately target emissions to water from the manufacture of grinding wheels in order to address the risks to the water environment (including sediment), to microorganisms in wastewater treatment plant and to soil via the application of sewage sludge.

2. It should control emissions at those sites where emissions are high whilst not imposing excessive costs upon those whose operations pose no unacceptable risks.

3. It should take account of any new production facilities which may begin operations using naphthalene in the manufacture of grinding wheels.

4. It should aim to achieve a balance between the costs of control and environmental benefits with this recognising that there are other emissions of naphthalene to the environment which cannot be controlled under the Existing Substances Regulation.

It is concluded that the most appropriate mechanism for control of emissions is under the proposed Water Framework Directive and the proposed amendment to the directive on sludge.

The Water Framework Directive would control emissions direct to watercourses and also those which occur following treatment in WWTP (and also due to any leaching from areas where it is deposited on soil via sewage sludge). If levels in sewage sludge are controlled under the proposed amendment to the Sludge Directive, this approach will serve to address all of the endpoints of concern.

Control under the Water Framework Directive will allow emissions of naphthalene to the environment to be controlled where they represent 'principal sources' of this substance in the environment. In addition, since the regime of the Water Framework Directive would impose ELVs in any case, the economic impacts for all stakeholders would be expected to be minimal.

Such an approach will take into account the fact that naphthalene can and is used in the manufacture of grinding wheels without causing any unacceptable risks to the environment. The use of uniform ELVs is, therefore, deemed to be an equitable means of ensuring that risks are within acceptable boundaries both now and in the future.

However, since both of the required legislative means for control are still at a proposed stage, this situation should be reviewed in the event that they are amended such that they would no longer provide an appropriate means of controlling the risks.

Manufacturers of grinding wheels are not located in all Member States and in fewer still is naphthalene used by this industry. However, requirements for control should be provided for at an EU level to ensure that any new facilities are covered. This will be the case if current proposals for the Water Framework Directive are adopted.

6.2 Recommendations

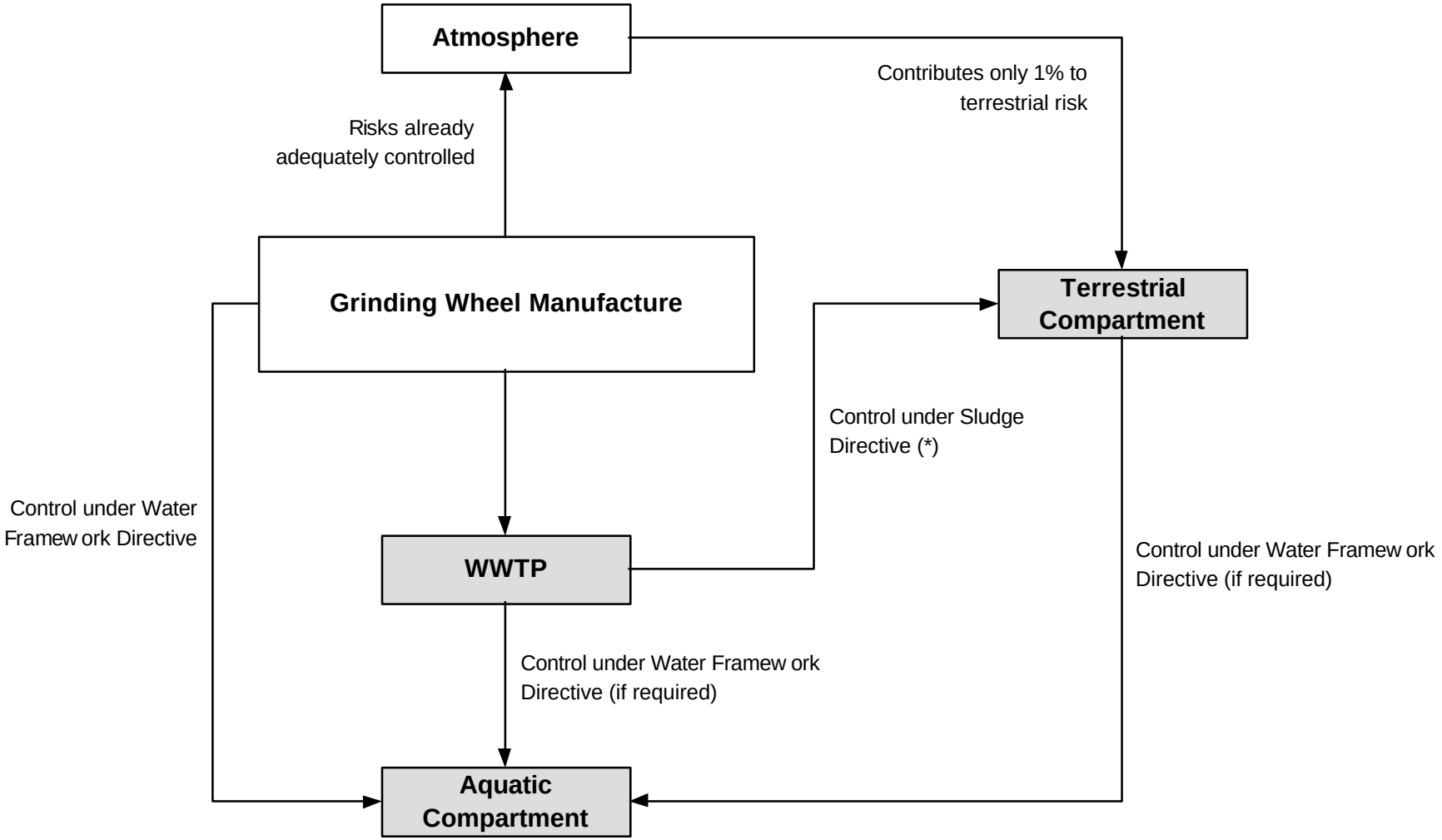
The proposed Risk Reduction Strategy is as follows:

1. Emission Limit Values should be set for the use of naphthalene in the manufacture of grinding wheels. These would be based upon the Best Available Techniques under the current proposals. Since Member States will be required to identify the 'principal sources' of pollution by priority substances, if risks to the environment continue to occur in the future then the process would come under control.

2. Levels of naphthalene in sewage sludge should be controlled through the proposed amendment to the Sludge Directive. This would be accomplished by ensuring either that sludge containing excessive levels of naphthalene are not applied to agricultural soil or that the relevant competent authority (e.g. sewage undertaker) places limits upon emissions of naphthalene to sewer.

It is considered that this strategy would provide the most cost-effective and practicable means of ensuring that the actual and potential risks from the use of naphthalene in manufacture of grinding wheels are controlled. In addition, it would require equal levels of emissions across manufacturers and would thus not impose excessive burdens upon individual companies. Furthermore, this strategy will take account of the fact that emissions are controlled to acceptable levels by most (if not all) companies and thus is deemed to be proportionate to the severity of the risks (since the mechanisms will be established irrespective of the above requirements). Figure 6.1 presents a summary of the proposed restrictions.

In the case that the proposals which are finally adopted no longer contain the appropriate means to address the risks of concern, the strategy will need to be reviewed.



Shaded boxes indicate w here the Risk Assessment has identified a need for further risk reduction measures

* Input to soil via sludge w ould be controlled by placing limits upon levels of naphthalene (as PAH). This could be achieved either by requiring that such sludge is not deposited on land or by sew age undertaker placing requirements for ELVs on grinding w heel manufacturing site

Figure 6.1: Summary of Risk Reduction Strategy

7. REFERENCES

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ANNEX 1

LIST OF ORGANISATIONS CONTACTED

ANNEX 1: LIST OF ORGANISATIONS CONTACTED

Trade Associations

Agrupacion Nacional de Fabricantes de Abrasivos (A.N.F.A.) (Spainish abrasives association)
British Abrasive Federation
British Hardware Federation
Fachverband der Stein und Keramishen Industrie Osterreichs (Austrian abrasives association)
Federation of British Engineers Tool Manufacturers
Federation of the European Producers of Abrasives (FEPA)
Federceramica - Settore Abrasivi (Italian abrasives association)
Gauge and Toolmakers Association
Machine Tool Technologies Association
Nederlandse Vereiniging van Abrasive Fabricanten (Dutch abrasives association)
Norske Slipmiddelprodusenter (N.S.F.) (Norwegian abrasives association)
Sveriges Slipverktysleverantorers Forening (S.S.L.) (Swedish abrasives association)
Verein Deutscher Schlefmittelwerke e.V.(German abrasives association)

Abrasives Manufacturers

Abrafract
Abrasive Blades Ltd
Dipl. Ing. Alexander Wirthl & Co (Austria)
Anglo Abrasives
Arrow Abrasives Ltd
ASI SPA (Italy)
Automatic Grinding Machines and Engineering
Beco Schleifmittelwerk GmbH (Austria)
Camfart SRL (Italy)
Carborundum Abrasives
Flexovit International (Netherlands)
Flexovit (UK) Ltd
Freudenberg Nonwovens Ltd
Gradinetti SRL (Italy)
Grinding Centre
Haywood and Son Abrasives
Hermes Abrasives Ltd
International Chips SRL (Italy)
Jowitt Grinding Wheels Ltd
Klingspor Abrasives Ltd
Marrose Abrasives Ltd
Micromold Italia SPA (Italy)
Mole Abrasivi Ermoli SRL (Italy)
Molemab SPA (Italy)
Molebab Inotech Schleifmittelindustrie GmbH (Austria)

Neuberger Holz und Kunstsoffindustrie GmbH (Austria)
Northern Abrasives
Norton Abrasives Ltd
Norton Abrasives S.A. (France and Spain)
Parini & C. SRL (Italy)
Rappold - Winterthur Technologie GmbH (Austria)
Siapi Abrasivi SPA (Italy)
SIFA SPA (Italy)
SIG Schleifmittel und Industriebedarf GmbH (Austria)
Slip Naxos (Sweden)
TIAC SRL (Italy)
Tyrolit (Austria)
Unicorn Abrasives
Universal Grinding

Others

Building Research Establishment
DETR (CBD)
DETR (Water Quality)
DETR (Water)
Environment Agency
Diplombiochemiker Toxicologe
European Environmental Pollution Prevention and Control Bureau, EIPPCB
INERIS (French Competent Authority for ESR Environmental Risk Assessment)
INRS (French Competent Authority for ESR Human Health Risk Assessment)

ANNEX 2

PROPOSED LIST OF PRIORITY SUBSTANCES IN THE FIELD OF WATER QUALITY

ANNEX 1: PROPOSED LIST OF PRIORITY SUBSTANCES

Table A2-1 details the proposed list of priority substances in the field of water quality. These would form the initial priorities for control under the Water Framework Directive, as proposed by the European Commission.

Table A2-1: Proposed List of Priority Substances in the Field of Water Quality

	CAS Number	EU Number	Name
1	15972-60-8	240-110-8	Alachlor
2	120-12-7	204-371-1	Anthracene
3	1912-24-9	217-617-8	Atrazine
4	71-43-2	200-753-7	Benzene
5	n.a.	n.a.	Brominated diphenylether[a]
6	7440-43-9	231-152-8	Cadmium and its compounds
7	85535-84-8	287-476-5	C_{10-13}-chloroalkanes[b]
8	470-90-6	207-432-0	Chlorfenvinphos
9	2921-88-2	220-864-4	Chlorpyrifos
10	75-09-2	200-838-9	Dichloromethane
11	107-06-2	203-458-1	1,2-Dichloroethane
12	117-81-7	204-211-0	Di(2-ethylhexyl)phthalate (DEHP)
13	330-54-1	206-354-4	Diuron
14	115-29-7	204-079-4	Endosulfan
	959-98-8	n.a.	(alpha-endosulfan)
15	118-74-1	204-273-9	Hexachlorobenzene
16	87-68-3	201-765-5	Hexachlorobutadiene
17	608-73-1	210-158-9	Hexachlorocyclohexane
	58-89-9	200-401-2	(gamma-isomer, Lindane)
18	34123-59-6	251-835-4	Isoproturon
19	7439-92-1	231-100-4	Lead and its compounds
20	7439-97-6	231-106-7	Mercury and its compounds
21	**91-20-3**	**202-049-5**	**Naphthalene**
22	7440-02-0	231-111-4	Nickel and its compounds
23	25154-52-3	246-672-0	Nonylphenols
	104-40-5	203-199-4	(4-(para)-nonylphenol)

Table A2-1: Proposed List of Priority Substances in the Field of Water Quality			
	CAS Number	**EU Number**	**Name**
24	1806-26-4	217-302-5	Octylphenols
	140-66-9	n.a.	(para-tert-octylphenol)
25	n.a.	n.a.	Polyaromatic hydrocarbons
	50-32-8	200-028-5	(Benzo(a)pyrene,
	205-99-2	205-911-9	Benzo(b)fluoroanthene,
	191-24-2	205-883-8	Benzo(g,h,i)perylene,
	207-08-9	205-916-6	Benzo(k)fluoroanthene,
	206-44-0	205-912-4	Fluoroanthene,
	193-39-5	205-893-2	Indeno(1,2,3-cd)pyrene)
26	608-93-5	210-172-5	Pentachlorobenzene
27	122-34-9	204-535-2	Simazine
28	87-86-5	201-778-6	Pentachlorophenol
29	688-73-3	211-704-4	Tributyltin compounds
	36643-28-4	n.a.	(Tributyltin-cation)
30	12002-48-1	234-413-4	Trichlorobenzenes
	120-82-1	204-428-0	(1,2,4-Trichlorobenzene)
31	67-66-3	200-663-8	Trichloromethane (Chloroform)
32	1582-09-8	216-428-8	Trifluralin

Source: CEC, 2000: Proposal for a European Parliament and Council Decision establishing the list of priority substances in the field of water policy, Commission of the European Communities COM (2000) 47 Final, Brussels, 7 February 2000.

a Where groups of substances have been selected, typical individual representatives are listed in brackets as indicative parameters. The establishment of controls will be targeted to these individual substances, without prejudicing the inclusion of other individual representatives where appropriate.

b These groups of substances normally include a considerable number of individual compounds. Presently, appropriate indicative parameters cannot be given.

ANNEX 3

COMPARISON OF NAPHTHALENE AND 1,4-DICHLOROBENZENE BASED ON RISK ASSESSMENTS

ANNEX 3 : COMPARISON OF NAPHTHALENE AND 1,4-DICHLOROBENZENE

Table 1: Summary Comparison of Naphthalene and 1,4-dichlorobenzene		
	Naphthalene	**1,4-dichlorobenzene**
Basic Information		
CAS Number	91-20-3	106-46-7
EINECS Number	202-049-5	203-400-5
Molecular Weight	128.18	147.01
Chemical Formula	C_8H_{10}	$C_6H_4C_{l2}$
Quantities Used (tpa)	140,000 tpa (at least 350 tpa in grinding wheels)	15,000 tpa (100 tpa in grinding wheels)
Physical Properties		
Physical State	Solid	Solid
Melting Point	80.0ºC (pure)	52.8 - 53.5ºC
Boiling Point	218ºC	173 - 174ºC
Vapour Pressure (Pa)	10.5 Pa at 25ºC	160 - 170 Pa at 20 °C 1330 Pa at 54.8°C
Water Solubility (mg/l)	30 mg/l	60 - 70 mg/l at 20 °C
Log K_{OW}	3.73	3.4
Density (Relative to water)	1.025 at 20ºC	1.25 - 1.46 g/cm3 at 20 °C 1.23 g/cm3 at 70ºC
Flash Point	79ºC (open cup)	65-66 °C (closed cup)
Autoignition	526ºC	None up to 500ºC
Explosive Properties	Explosive limits in air % by volume: l=0.9, h=5.9	Explosive limits in air % by volume: l=1.7, h= 5.9
Oxidising Properties	Not oxidising	Not expected to be oxidising
Environmental Fate and Pathways		
Photodegradation	$t_{1/2}$ = 25 to 550 h in water	
Stability in Soil	K_{OC} = 1320 l/kg	K_{OC} = 450 l/kg
Stability in Water	Hydrolysis not expected	Hydrolysis not expected
Monitoring Data	None for manufacture of grinding wheels	None for manufacture of grinding wheels

Table 1: Summary Comparison of Naphthalene and 1,4-dichlorobenzene		
	Naphthalene	**1,4-dichlorobenzene**
Environmental Partitioning		Mackay Level I model gives: air 98.9 %; water 0.79 %; soil 0.15 %; sediment 0.16 % (see below also)
Biodegradation	Considered inherently biodegradable	Considered readily biodegradable
Bioaccumulation	BCF = 427	BCF = 296
Environmental Effects		
Aquatic PNEC	2.4 microg/l	20 microg/l
WWTP PNEC	2.9 mg/l	8.6 mg/l
Sediment PNEC	70.0 microg/kg	900 microg/kg
Terrestrial PNEC	56.3 microg/kg	84.7 microg/kg
Labelling		
Labelling Requirements	Current: R50, R53, S61 Proposed: R22, S60 (additional)	Current: Xn, R22, R36/38, S2, S22, S24/25, S46 Proposed: Xi, N, R36, R50/53, S2, S24/25, S46, S60/61
Conclusions of Risk Assessment		
Environment	Need for limiting risks from manufacture of grinding wheels for aquatic compartment (including sediment), microorganisms in sewage treatment, and for soil from the application of sewage sludge	No additional risk reduction measures required
Human Health	No current risk reduction measures currently envisaged for naphthalene in grinding wheels	Need for limiting risks to workers based upon estimated occupational exposure

Labels: Xn - Harmful, Xi - Irritant, N - Dangerous for the environment.

Risk Phrases: R22 Harmful if swallowed, R36 Irritating to eyes, R36/38 Irritating to eyes and skin, R50 Very toxic to aquatic organisms, R53 May cause long-term adverse effects in the aquatic environment.

Safety Phrases: S2 Keep out of the reach of children, S22 Do not breathe dust, S46 If swallowed, seek medical advise immediately and show this container or label, S60 This material and its container must be disposed of as hazardous waste, S 61 Avoid release to the environment. Refer to special instructions/Safety data sheets, S24/25 Avoid contact with skin and eyes.