
Highways Agency Hazardous Materials in Infrastructure Construction: Project Report

Package Order: 347(4/45/12)HALC

Prepared for
Highways Agency

May 2015

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1 Introduction

1.1 Introduction

TRL-Halcrow JV, c/o CH2M HILL has been commissioned by the Highways Agency (HA) to undertake a scoping feasibility study to assist the Agency in gaining a deeper understanding of the purchased materials, substances and mixtures currently used to deliver HA services in respect of the risks they pose to human health and the environment. This project focuses on identifying the materials, substances and mixtures that may be harmful, assessing the relative harm to all receptors producing a risk based priority list, of the substances or associated working methods should be tackled by the HA in the short, medium and long term.

1.2 Project objectives

The two principal objectives of this project are to:

1. Identify the purchased materials, substances and mixtures currently used in the activities to construct, maintain, operate and decommission the HA network with the potential to cause harm to human health or the environment; and
2. Screen the materials, substances and mixtures to assess the relative harm to all receptors and develop a prioritised list, based on risk, identifying opportunities to remove the human health and environmental hazards identified.

As an initial scoping study the project has focused on developing and testing the feasibility of a method to identify and screen hazardous materials and substances and identify where there might be opportunities to remove human health and environmental hazards rather than proposing a specific actions to remove these hazards.

1.3 Scope

The project has followed a four stage process outlined below, this report summarises the findings of each of these stages:

Step 1: a review of the regulatory environment for controlling the use of hazardous materials, substances, mixtures;

Step 2: identification of the hazardous materials, substances and mixtures used in delivering HA services;

Step 3: screening the list of materials, substances and mixtures;

Step 4: development of a priority list of materials, substances and mixtures.

The project scope is limited to those materials, substances and mixtures currently being used in delivering HA services not legacy materials (for example those being extracted as wastes) which are already considered by other mechanisms. The hazards under consideration are only those that may materialise whilst the material or substance is 'in use' on the HA network (over the long or short term) not those that occur in the upstream supply chain (e.g. during manufacturing).

2 Defining the regulatory environment for controlling hazardous materials, substances and mixtures

2.1 Introduction

This section reviews the regulatory environment for classifying and controlling the use of hazardous materials, substances and mixtures. Specifically this section provides a summary of the key legislative instruments:

- defining the basis for health, safety and environmental management requirements;
- defining hazardous materials, substances and mixtures;
- relating to the classification, labelling and handling of hazardous materials, substances and mixtures;
- requiring the communication of hazard information to users;
- restricting or controlling materials, substances and mixtures hazardous to health and the environment; and,
- controlling the discharge of hazardous materials, substances and mixtures into the environment.

This review has been used to form the basis for the project definition of what constitutes a hazardous material, substance and mixture for Step 2 of the project and identify any relevant hazard categorisation information, from the regulations, that can inform the screening criteria to be developed in Step 3. The regulatory review has also been used to inform the development of the subsequent data request to HA delivery partners.

2.2 Key legislation relevant to this project

The following European regulations, national legislation and guidance have been considered in the production of this report.

2.2.1 *European regulations:*

- European Regulation on classification, labelling and packaging of substances and mixtures (EC 1272/2008) (the CLP Regulation);
- The European Regulation on Registration, Evaluation, Authorisation and restriction of Chemicals (EC 1907/2006) (REACH);
- Biocides Regulation (EU 528/2012);
- Directive 1999/45/EC - classification, packaging and labelling of dangerous preparations (DPD);
- Council Directive 91/689/EEC of 12 December 1991 on hazardous waste;
- Directive 67/548/EEC - classification, packaging and labelling of dangerous substances (DSD).

2.2.2 *National legislation:*

- The Health and Safety at Work etc. ACT 1974;
- The Management of Health and Safety at Work Regulations 1999;
- The Construction Products Regulations 2011;
- The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2008, as amended (RoHS);
- The Control of Asbestos Regulations 2012;
- The Plant Protection Products (Sustainable Use) Regulations 2012;
- The Environmental Permitting (England and Wales) Regulations 2007 (as amended);
- The Control of Artificial Optical Radiation at Work Regulations (AOR) 2010;
- The Construction (Design and Management) Regulations 2007 (CDM);
- Hazardous Waste (England and Wales) Regulations 2005;
- The List of Wastes Regulations 2005;
- The Control of Substances Hazardous to Health Regulations 2002 (as amended in 2004) (COSHH);
- The Control of Lead at Work Regulations (CLAW) 2002;
- The Ionising Radiations Regulations 1999;

- Water Resources Act 1991;
- The Environmental Protection Act 1990.

2.2.3 Health, safety and environmental quality standards:

- EH40 Workplace Exposure Limits (WEL): Containing the list of WELs for use with the Control of Substances Hazardous to Health Regulations 2002 (as amended);
- Proposal for a Directive amending the Water Framework Directive (WFD) and Environmental Quality Standards (EQSD) (Directive 2008/105/EC) (COM(2011)876);
- Environment Agency Chemical Standards (also known as Environmental Quality Standards (EQS)).

2.3 Legislative Review

This section provides a summary of the regulatory environment, pertaining to the Step 1 objectives, for classifying and controlling the use of hazardous materials, substances and mixtures. The first parts of this review provide a project definition of a hazardous material or substance and considers the hazards posed by these substances. Hazards are considered both in terms of the risks posed to human health and the environment and the mechanisms for communicating these risks to those working with the substances, for example, during infrastructure construction and subsequent maintenance or deconstruction of the asset. The last parts of the regulatory review are concerned with the legislative controls covering the release of hazardous substances into air, water or land.

2.3.1 Legislation defining the basis for the control of hazardous materials substances and mixtures

HSE (1999) states that the Health and Safety at Work etc. Act 1974 sets out the general duties which employers have towards employees and members of the public, and employees have to themselves and to each other. Part 1 of the Act is directly relevant to this project as it requires ‘*so far as is reasonably practicable*’:

- a) Securing the health, safety and welfare of persons at work;
- b) Protecting persons other than persons at work against risks to health or safety arising out of or in connection with the activities of the persons at work;
- c) Controlling the keeping and use of explosives or highly flammable or otherwise dangerous substances, and generally preventing the unlawful acquisition, possession and use of such substances;
- d) Controlling the emission into the atmosphere of noxious or offensive substances from premises of any class.

The Management of Health and Safety at Work Regulations 1999 requires, amongst other things, that all employers and self-employed people assess the risks to workers and any others who may be affected by their work or business. This will enable them to identify the measures they need to take to comply with health and safety law (i.e. The Health and Safety at Work etc. Act 1974).

In the case of work with materials, substances or mixtures hazardous to health, these duties are further reinforced by the requirements of the Control of Substances Hazardous to Health (COSHH) Regulations (1999) (as amended). The key requirement of the COSHH Regulations is Regulation 6 (Risk Assessment), i.e.: “*An employer should not carry out work that is liable to expose employees to substances hazardous to health until all risks have been evaluated and minimised as set down in the regulations*”.

Notwithstanding, HSE (2005) states that Regulation 7 stipulates that preventing exposure should always be the first consideration and emphasises the need for substitution of either the substance or the process to eliminate or reduce the risk of exposure. Employers should consider whether it is possible to significantly reduce exposure by using either – an alternative substance; a different form of the same substance; or a different or modified process.

The HSE (n.d.) advises that there are seven steps to practical, well thought out decisions about substitution:

- 1) Decide whether the substance or process is a hazard;
- 2) Identify the alternatives;
- 3) Think about what could happen if the alternatives are used;
- 4) Compare the alternatives with each other and with the substance or process currently being used;
- 5) Decide whether to substitute;
- 6) Introduce the substitute;
- 7) Assess how it is working.

2.3.2 Legislation defining hazardous materials, substances and mixtures; and affecting their classification, labelling and handling

The regulatory review has identified that a material, article, substance or mixture is likely to be hazardous to human health and/or the environment where it contains a substance:

- a) That meets the criteria for classification as 'hazardous' according to the CLP Regulation, or (until 1 June 2015¹) 'dangerous' according to the Dangerous Substances Directive 67/548/EEC or Dangerous Preparations Directive, 1999/45/EC;
- b) Which is persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB), according to the criteria given in Annex XIII of the REACH Regulation;
- c) Included in the European Chemicals Agency's 'candidate list' of substances of very high concern (SVHC) for eventual authorisation according to Article 59 (1) of the REACH Regulation (including articles containing a SVHC on the candidate list in a concentration above 0.1% w/w);
- d) That has been assigned a Workplace Exposure Limit (WEL) for use with the COSHH Regulations²;
- e) Classified as a 'priority substance' or 'priority hazardous substance' according to the Proposal for a Directive amending the Water Framework Directive (WFD) and Environmental Quality Standards (EQSD) (Directive 2008/105/EC) (COM(2011)876); or listed in the Environment Agency's Chemical Standards Database (covering statutory and non-statutory chemicals of concern);
- f) Which, at the end of its life, is likely to be classified as a hazardous waste according to the Waste Framework Directive and List of Wastes Decision (2000/532/EC);
- g) That is subject to notification under the Ionising Radiations Regulations 1999, Control of Artificial Optical Radiation at Work Regulations (AOR) 2010, or the Radioactive Substances Act 1993.

2.3.2.1 CLP Regulation

The European Commission (2013) states that the Classification, Labelling and Packaging of Substances and Mixtures Regulation (CLP) implements in the EU the Globally Harmonized System (GHS) of Classification and Labelling of Chemicals. The key aims of the CLP Regulation are to set out criteria for classifying chemicals according to their health, environmental and physical hazards; and to give hazard communication requirements for labelling and safety data sheets.

CLP aims to identify the hazardous properties of chemical substances and mixtures so that end users can undertake a risk assessment appropriate to how they intend to use the substance or mixture. CLP is based on a system of hazard classes, and within each hazard class there may be one or more hazard categories

¹ The Dangerous Substances Directive and the Dangerous Preparations Directive are being replaced by the direct-acting European CLP Regulation. From 1 June 2015, both Directives will be fully withdrawn and will no longer have any legal effect. From 1 June 2015, chemical suppliers must therefore comply with the CLP Regulation.

² A WEL is the concentration of a hazardous substance in air, averaged over a specified period of time, which must not be exceeded.

(or divisions) depending on the degree of hazard posed by the substance or mixture (European Commission, 2013).

A list of all harmonised classifications is provided in Appendix A and Appendix B. Appendix A lists the harmonised classifications agreed under the CLP Regulation. Whereas, Appendix B lists the same harmonised classifications, but the entries are classified and labelled according to the Dangerous Substances Directive. These dual classifications are permitted under CLP to be used until 1 June 2015, when CLP repeals the Dangerous Substances Directive and Dangerous Preparations Directive in full. Conversion tables from classification under the Dangerous Substances Directive to classification and assignment of hazard statements under CLP can be found in Appendix C.

Hazard classes

Hazard classes, provided in CLP, define the nature/severity of a physical, health or environmental hazard associated with each class. All substances³, mixtures⁴ and articles⁵ meeting the criteria⁶ of one or more of the hazards, laid down in Annex I of the CLP Regulation, are considered to be “hazardous” (ECHA, 2009).

Physical Hazards

I.e. hazards that may cause harm to workers through their ability to explode, burn or react with other chemicals in a dangerous way which threatens the physical safety of the worker (ECHA, 2009):

- Explosives^{D7}
- Flammable gases^D
- Flammable aerosols
- Oxidising gases^D
- Gases under pressure (Compressed gas, liquefied gas, refrigerated liquefied gas, dissolved gas)
- Flammable liquids^D
- Flammable solids^D
- Self-reactive substances and mixtures^D
- Pyrophoric liquids^D
- Pyrophoric solids^D
- Self-heating substances and mixtures
- Substances and mixtures which in contact with water emit flammable gases^D
- Oxidising liquids^D
- Oxidising solids^D
- Organic peroxides^D
- Corrosive to metals

³ “A chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any identified 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” (CLP Article 2(7)).

⁴ “A mixture or solution composed of two or more substances” (CLP Article 2(8)). The CLP definition of a mixture differs slightly from that of the UN GHS which may well be applied outside of the EU.

⁵ “Specifically in the combinations ‘explosive articles’, ‘pyrotechnic article’ or ‘substances, mixtures and articles’..... which are manufactured with a view to producing a practical, explosive or pyrotechnic effect”.

⁶ These criteria include Specific Concentration Limits, M-factors, Generic Cut-off Values and Generic Concentration Limits.

⁷ “D” identifies CLP hazard classifications (whole hazard class or the highlighted categories) which reflect “classified as dangerous” under Dangerous Substances Directive or Dangerous Preparations Directive.

Health hazards

I.e. hazards that may have harmful effects on the health of workers either in the short term (acute hazards) or in the long term (chronic hazards) (ECHA, 2009):

- Acute toxicity^D
- Skin corrosion/irritation^D
- Serious eye damage/eye irritation^D
- Respiratory or skin sensitisation^D
- Germ cell mutagenicity^D
- Carcinogenicity^D
- Reproductive toxicity^D plus additional category for effects on or via lactation
- Specific target organ toxicity – single exposure
- Specific target organ toxicity – repeated exposure^D
- Aspiration hazard^D

Environmental hazards

I.e. hazards which may cause harmful effects to organisms in the environment, in either the short term (acute hazards) or long term (chronic hazards) (ECHA, 2009):

- Hazardous to the aquatic environment^D
- Hazardous to the ozone layer^D

Hazard categories

European Commission (2013) confirms that CLP is based on a system of hazard classes, and within each hazard class there is one or more hazard categories (or divisions) depending on the degree of hazard posed by the substance or mixture. These hazard categories are provided in Table 1 along with the degree of hazard they present.

Table 1: CLP Hazards Classes and Categories (adapted from European Commission 2013 and ECHA 2009)

Hazard Class	Hazard Category (Red, Danger; Orange, Warning) ⁸						
Physical Hazards							
Explosives	Unstable	Div 1.1	Div 1.2	Div 1.3	Div 1.4	Div 1.5	Div 1.6
Flammable Gases	1	2					
Flammable Aerosols	1	2	3				
Oxidising Gases	1						
Pressurised Gases:							
Compressed Gases	1						
Liquefied Gases	1						
Refrigerated Liquefied Gases	1						
Dissolved Gases	1						
Flammable Liquids	1	2	3				
Flammable Solids	1	2					
Self-reactive Substances	Type A	Type B	Type C	Type D	Type E	Type F	Type G
Pyrophoric Liquids	1						
Pyrophoric Solids	1						
Self-heating Substances	1	2					
Water Reactive > Flammable Gases	1	2	3				
Oxidising Liquids	1	2	3				

⁸ CLP uses a signal word to highlight the danger level. The new signal word has two levels: “Danger — those substances and mixtures with the most severe hazards” and “Warning — those substances and mixtures with less serious hazards”. Note, in some case no signal word is provided (for example aquatic toxicity 2, 3 and 4).

Hazard Class	Hazard Category (Red, Danger; Orange, Warning) ⁹						
Oxidising Solids	1	2	3				
Organic Peroxides	Type A	Type B	Type C	Type D	Type E	Type F	Type G
Corrosive to Metals	1						
Health Hazards							
Acute Toxicity, Oral	1	2	3	4			
Acute Toxicity, Dermal	1	2	3	4			
Acute Toxicity, Inhalation	1	2	3	4			
Aspiration hazard	1						
Skin Corrosion/Irritation (Dermal Corrosion = Eye Corrosion)	1A	1 (Corrosion) 1B	1C	Irritation 2			
Eye Irritation	1	2					
Respiratory Sensitisation	1	(1A)	(1B)				
Skin Sensitisation	1	(1A)	(1B)				
Germ Cell Mutagenicity	1A	1B	2				
Carcinogenicity	1A	1B	2				
Reproductive Toxicity - Fertility	1A	1B	2			Lactation	
Reproductive Toxicity - Development	1A	1B	2				
Target Organ SysTox - Single Dose	1	2	3				
Target Organ SysTox - Repeat Dose	1	2					
Environmental Hazards							
Acute Aquatic Toxicity	1	2	3				
Chronic Aquatic Toxicity	1	2	3	4			
Hazardous To The Ozone Layer	1						



A short code system has been developed, for use throughout the EU, based on the English class names, e.g. 'Flam. Liq. 2' is used as a short code for Flammable Liquid Category. The classes are also referred to in the REACH Regulation by a class numbering, where the class number is the section reference in CLP Annex I for that hazard class, e.g. flammable liquids are 'Class 2.6' (EC, 2013).

Hazard and Precautionary Statements

Hazard (H) statements are used under CLP to describe the nature of the physical, health or environmental hazards of a substance or mixture, including, where appropriate, the degree of hazard. Hazard statements are determined by the application of the classification criteria, defined in Table 1, and should be accompanied by the corresponding H-statement number to provide a complete description of the type of hazard in the substance or mixture, e.g. 'Flam. Liq. 2, H225', 'Carc. 1A, H350', Aquatic Chronic 2, H411.

Precautionary (P) statements are used under CLP to provide a description of the measure or measures recommended to minimise or prevent adverse effects resulting from exposure to a hazardous substance or mixture due to its use. Precautionary statements also give advice on emergency response actions such as first aid and advice on safe storage and disposal.

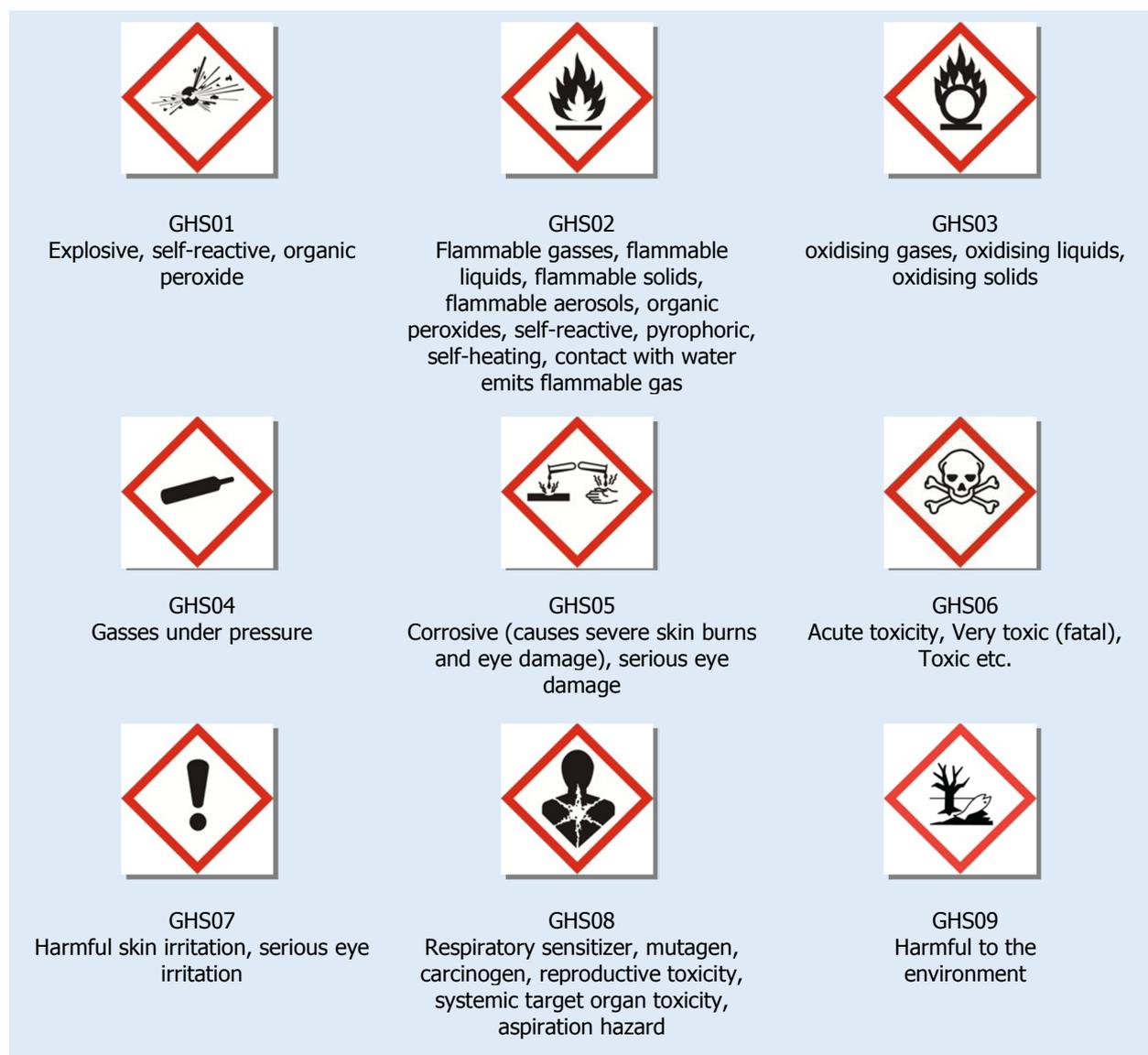
The complete list of Hazard and Precautionary statements is provided in Appendix D.

Hazard Pictograms

Hazard pictograms are used under CLP to communicate a pictorial representation of a particular hazard. The classification and categorisation of a substance or mixture determines the hazard pictograms that should be displayed on any labelling, as set out in Part 2 (physical hazards), Part 3 (health hazards) and Part 4 (environmental hazards) of Annex I to CLP.

⁹ CLP uses a signal word to highlight the danger level. The new signal word has two levels: "Danger — those substances and mixtures with the most severe hazards" and "Warning — those substances and mixtures with less serious hazards". Note, in some case no signal word is provided (for example aquatic toxicity 2, 3 and 4).

Figure 1: Hazard Pictograms



Supplementary information

Supplementary information, under CLP, typically includes any of the additional labelling phrases included in CLP, but that are not part of the United Nations GHS (e.g. the EUH-Statements referred to above). It will also contain any other regulatory information that may be required as part of other Community acts, e.g. the additional labelling elements required for biocidal products authorised under Directive 98/8/EC, plant protection products authorised under Council Directive 91/414/EEC, the content of volatile organic compounds of paints according to Directive 2004/42/EC or any labelling required by Annex XVII to the REACH Regulation.

2.3.2.2 REACH Regulation

PBT and VPvB

Environment Agency (2010) confirms that potentially persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) chemicals are substances of very high concern because of their persistence (or recalcitrance), their ability to accumulate in living organisms, their capacity of travelling long distances and their high toxicity. A substance is defined as PBT or vPvB if it meets the criteria outlined in Annex XIII of REACH (Table 2).

Table 2: PBT and vPvB criteria

Property	PBT criteria	vPvB criteria
Persistence (P)	T1/2 > 60 days in marine water, or	T1/2 > 60 days in marine, fresh- or estuarine water,
	T1/2 > 40 days in fresh- or estuarine water, or	T1/2 > 180 days in marine, fresh- or
Bioaccumulation (B)	T1/2 > 180 days in marine sediment, or	T1/2 > 180 days in soil
	T1/2 > 120 days in fresh- or estuarine sediment, or	
	T1/2 > 120 days in soil	
	BCF > 2000 l/kg	BCF > 5000 l/kg
Toxicity (T)	NOEC < 0.01 mg/l for marine or freshwater organisms, or	
	Substance is classified as carcinogenic (category 1 or 2), mutagenic (category 1 or 2) or toxic for reproduction (category 1, 2 or 3), or	
	There is other evidence of chronic toxicity, as identified by the classifications: T, R48, or Xn, R48 according to Directive 67/548/EEC.	

*BCF, bioconcentration factor; NOEC, no observed effect concentration; T1/2, environmental half-life.

SVHC

HSE (2104) states that substances of very high concern (SVHC) are substances that have hazards with serious consequences, e.g., they cause cancer, or they have other hazardous properties and/or remain in the environment for a long time with their amounts in animals gradually building up over time. The criteria, provided in REACH Article 57, for SVHC are:

- Substances meeting the criteria for classification as carcinogenic, mutagenic or toxic for reproduction (CMR) category 1A or 1B in accordance the CLP Regulation;
- Substances which are persistent, bio-accumulative and toxic (PBT) in accordance with the criteria set out in Annex XIII of the REACH Regulation;
- Substances which are very persistent and very bio-accumulative (vPvB) in accordance with the criteria set out in Annex XIII of the REACH Regulation;
- Substances giving rise to an equivalent level of concern to substances meeting the above criteria. Such substances may have endocrine disrupting properties or have properties, that although not meeting the criteria for being a CMR, PBT or vPvB, there is scientific evidence of probable serious effects to human health or the environment. Such substances will be identified on a case-by-case basis.

The Candidate List of SVHC for Authorisation can be found at: <http://echa.europa.eu/candidate-list-table>. Substances that are subject to authorisation, under REACH, may not be used in the EU unless a company (and their registered users) have been authorised to do so. This will mean that such substances are eventually phased out of all non-essential uses. The current REACH Authorisation List can be viewed at: <http://echa.europa.eu/addressing-chemicals-of-concern/authorisation/recommendation-for-inclusion-in-the-authorisation-list/authorisation-list>.

2.3.2.3 WELs for use with the COSHH Regulations

HSE (2011) reports that workplace exposure limits (WELs), for use with the COSHH Regulations, provide the basis for controlling airborne contamination of the working environment. They define standards for air quality in terms of the amount of a particular substance which is acceptable in the atmosphere. Substances that have been assigned a WEL are subject to the requirements of COSHH Regulations. These Regulations require employers to prevent or control exposure to hazardous substances. These substance are capable of causing cancer (and/or heritable genetic damage), occupational asthma or lead to systemic toxicity though:

- too much being taken into the body through breathing;
- being absorbed through the skin;
- being swallowed; or
- acting directly on the body at the point of contact, e.g. the skin.

WELs are occupational exposure limits and are set in order to help protect the health of workers. The WELs for substances hazardous to health are published in HSE Guidance Note EH40/2005. However, the occupational exposure limit for lead and asbestos containing materials are set out in their own specific legislation: The Control of Lead at Work Regulations 2002 and The Control of Asbestos Regulations 2012.

2.3.2.4 Directive amending the WFD and EQSD (COM(2011)876)

The European Commission (2012) reports that forty eight substances or groups of substances have been classified as priority substances, for which environmental quality standards (EQS)¹⁰ have been set, including selected chemicals, plant protection products, biocides, metals and other groups like polyaromatic hydrocarbons (PAH) that are mainly incineration by-products and polybrominated biphenylethers (PBDE) that are used as flame retardants. These substances were selected from amongst those presenting a significant risk to or via the aquatic environment, using the approaches outlined in Article 16 of the Water Framework Directive.

2.3.2.5 Environment Agency Chemical Standards Database

The Environment Agency maintains a database of 1,072 statutory standards (including EQS) and non-statutory chemical standards that are currently in use by the Environment Agency. The non-statutory are set by various organisations (including the Environment Agency) for chemicals that are considered to be of concern, but are not covered by any specific legislation. The standard database can be found at: <http://evidence.environment-agency.gov.uk/ChemicalStandards/Home.aspx>

Chemical standards are numeric values expressed as a chemical concentration (e.g. 12 mg/l, 0.57 µg/kg, etc.) in an environmental medium such as water, air or soil. These values describe concentrations of chemicals that are not expected to cause harm to environmental organisms or human health, provided they are not exceeded. The same chemical may have several standards for different environmental media, and for different protection goals.

2.3.2.6 Hazardous Waste Directive

Environment Agency (2013) states that a hazardous waste is a waste that has one or more of the fifteen specified hazardous properties (or hazard codes¹¹) listed in Annex III to the Waste Framework Directive:

- H1 'Explosive': substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene.
- H2 'Oxidising': substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances.
- H3-A 'Highly Flammable':
 - Liquid substances and preparations having a flash point below 21°C (including extremely flammable liquids), or
 - Substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy, or
 - Solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition, or

¹⁰ "Environmental quality standard" (EQS) means the concentration of a particular pollutant or group of pollutants in water, sediment (any material transported by water and settled to the bottom) or biota (all living organisms of an area) which should not be exceeded in order to protect human health and the environment.

¹¹ The majority of the hazard codes are assigned based on the corresponding hazard class and hazard statements under the CLP Regulations.

- Gaseous substances and preparations which are flammable in air at normal pressure, or
- Substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.
- H3-B 'Flammable': liquid substances and preparations having a flash point equal to or greater than 21°C and less than or equal to 55°C
- H4 'Irritant': non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.
- H5 'Harmful': substances and preparations which, if they are inhaled or ingested, or if they penetrate the skin, may involve limited health risks.
- H6 'Toxic': substances and preparations (including very toxic substances and preparations) which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death.
- H7 'Carcinogenic': substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence.
- H8 'Corrosive': substances and preparations which may destroy living tissue on contact.
- H9 'Infectious': substances containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or other living organisms.
- H10 'Toxic for reproduction': substances and preparation which, if they are inhaled or ingested or if they penetrate the skin, may induce non-hereditary congenital malformations or increase their incidence.
- H11 'Mutagenic': substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce hereditary genetic defects or increase their incidence.
- H12 Substances and preparations which release toxic or very toxic gases in contact with water, air or an acid.
- H13 Substances and preparations capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics listed above.
- H14 'Ecotoxic': substances and preparations which present or may present immediate or delayed risks for one or more sectors of the environment.

Environment Agency (2013) reports that the application of this is determined by the List of Wastes Decision (2000/532/EC) which provides:

- A List of Waste (LoW), often called the European Waste Catalogue (EWC);
- The rules for using the list;
- The criteria used to assess if a waste on the list is hazardous.

The LoW is a catalogue of all wastes. It is divided into 20 chapters. The chapters contain 839 waste entries, given a six-digit code, split into three types:

- Wastes that are always hazardous, known as "absolute" hazardous entries;
- Wastes that are always non-hazardous, known as "absolute" non-hazardous entries; and
- Wastes that may be hazardous or non-hazardous, known as "mirror hazardous" and "mirror non-hazardous entries" based on whether concentrations of dangerous substances in the waste exceed the thresholds set in the Hazardous Waste Directive as transposed by the Hazardous Waste (England and Wales) Regulations 2005; and provided in Environment Agency (2013) Technical Guidance WM2- Hazardous waste Interpretation of the definition and classification of hazardous waste (3rd Edition).

2.3.2.7 Legislation covering ionizing and nonionizing radioactive material¹²

Ionising and nonionising sources of radiation that are subject to notification under the Ionising Radiations Regulations 1999, Control of Artificial Optical Radiation at Work Regulations (AOR) 2010 or the Radioactive Substances Act 1993 are detailed in the following guidance:

- HSE (200), Work with ionising radiation Ionising Radiations Regulations 1999 - Approved Code of Practice and guidance <http://www.hse.gov.uk/pubns/priced/l121.pdf>
- HSE (2010), Guidance for Employers on the Control of Artificial Optical Radiation¹³ at Work Regulations (AOR) 2010 <http://www.hse.gov.uk/radiation/nonionising/employers-aor.pdf>
- Radioactive Substances Act 1993 <http://www.legislation.gov.uk/ukpga/1993/12/contents>

2.3.3 Legislation requiring the communication of hazard information to users

2.3.3.1 REACH Regulation

ECHA (2014) confirms that safety data sheets (SDS) are the main mechanism for ensuring that suppliers communicate enough information along the supply chain to allow the safe use of their substances and mixtures (i.e. without risk of harm to users or the environment). SDS include information about the properties of the substance (or mixture), its hazards and instructions for handling, disposal and transport and also first-aid, fire-fighting and exposure control measures. This information can be found in the main body of the SDS or in the annexed exposure scenarios (where applicable).

HSE (2012) states that the requirements for the compilation of the safety data sheets are specified in Annex II of REACH. REACH, amongst other things, specifies that suppliers must provide a Safety Data Sheet (SDS)¹⁴ where:

1. They supply a:
 - a) substance or a mixture that is classified as hazardous under the CLP Regulation or classified as dangerous under Dangerous Substances Directive 67/548/EEC or Dangerous Preparations Directive, 1999/45/EC; or
 - b) a mixture meets the criteria for classification as dangerous according to the Dangerous Preparations Directive 1999/45/EC (DPD) (until 1 June 2015) or;
 - c) a substance that is persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) as defined in Annex XIII of REACH; or
 - d) a substance that included in the European Chemicals Agency's 'Candidate List' of substances of very high concern for reasons other than (a), (b) and (c) given above.
2. A customer requests a SDS for a mixture that is not classified as dangerous under Directive 1999/45/EC, but contains either:
 - a) a substance posing human health or environmental hazards in an individual concentration of ≥ 1 % by weight for mixtures that are solid or liquids (i.e., non-gaseous mixtures) or ≥ 0.2 % by volume for gaseous mixtures; or
 - b) a substance that is PBT, or vPvB in an individual concentration of ≥ 0.1 % by weight for mixtures that are solid or liquids (i.e., non-gaseous mixtures); or
 - c) a substance on the 'Candidate List' of substances of very high concern (for reasons other than those listed above), in an individual concentration of ≥ 0.1 % by weight for non-gaseous mixtures; or

¹² Specialist construction contractors use a variety of sealed and unsealed radioactive sources. Unsealed sources may be used during grouting or cementing operations or for installation equipment tracing studies. Sealed radioactive sources may be used for well logging or in liquid level and density gauges.

¹³ Artificial Optical Radiation includes light emitted from all artificial sources in all its forms such as ultraviolet, infrared and laser beams, but excludes sunlight. Hazardous sources of light that present a 'reasonably foreseeable' risk of harming the eyes and skin of construction site workers (i.e. where control measures are needed) are likely to be limited to metal working – welding (both arc and oxy-fuel) and plasma cutting.

¹⁴ Safety data sheets provide information on substances that are 'dangerous for supply'. Other substances should have instructions for safe use.

- d) a substance for which there are Europe-wide workplace exposure limits, i.e. a substance or mixture that is not classified as dangerous where it has a relevant national workplace exposure limit value.
3. They are a supplier of a product listed as a 'special case' in paragraph 1.3 of Annex 1 of the CLP Regulation (EC) No 1272/2008 for which there are labelling derogations; e.g., gas containers intended for propane, butane or liquefied petroleum gas.

HSE (2012) reports that the safety data sheet must be dated and must contain the following headings:

1. Identification of the substance/mixture and of the company/undertaking;
2. Hazards identification;
3. Composition/information on ingredients;
4. First-aid measures;
5. Fire-fighting measures;
6. Accidental release measures;
7. Handling and storage;
8. Exposure controls/personal protection;
9. Physical and chemical properties;
10. Stability and reactivity;
11. Toxicological information;
12. Ecological information;
13. Disposal considerations;
14. Transport information;
15. Regulatory information;
16. Other information.

In addition, HSE (2012) confirms that SDS for substances or mixtures containing substances that have been fully registered under REACH will require inclusion of the following information:

- Registration numbers where appropriate;
- The identified use(s) and uses advised against;
- Exposure scenarios including any risk management measures required, in an Annex to the SDS. The information in the SDS should be consistent with the information in the chemical safety report (CSR) for that substance, or a mixture if a CSA for the mixture is available;
- The Derived No Effect Level (DNEL) which represents a level of exposure above which humans should not be exposed; and Predicted No Effect Concentration (PNEC) which represents the concentration of a chemical in any environmental compartment below which unacceptable effects will most likely not occur.

HSE (2012) suggests that a SDS should be provided to the recipient either before or at the time of first delivery of the substance or mixture. Where a customer re-orders substances or mixtures, then the supplier does not need to re-supply the SDS, unless the sheet's contents have changed. There is no statutory review period for revising a SDS; however, it needs to be updated:

- As soon as new hazard information or information that may affect the risk management measures becomes available; or
- When a substance or mixture is classified according to the CLP Regulation; or
- Once an authorisation under REACH is granted or refused; or
- Once a restriction under REACH has been imposed.

When a SDS is updated, the new dated version of the SDS, identified as 'Revision: date', shall be supplied to all customers (of the substance/mixture in question) from the preceding 12 months (HSE, 2012).

2.3.3.2 COSHH

The COSHH Regulations aim to protect the health and safety of people who may be exposed to hazardous substances on site. The Regulations require an assessment to be carried out on all sites where there is a risk of exposure to hazardous substances. This assessment should be based on the information provided in supplier SDS. The assessment should be documented together with any further action required. In all cases employees need to be informed about any risks and need to use control measures such as ventilation equipment or PPE for the particular task (HSE, 2011).

2.3.3.3 The Construction (Design and Management) Regulations 2007 (CDM):

Any construction projects notifiable under the CDM Regulations require the consideration of hazardous materials, substances and mixtures in both the Construction Phase Plan and Health and Safety Plan:

Construction Phase Plan

The construction phase plan should typically include, amongst other things, the contractors' risk assessments and health and safety method statements for any high-risk activities (e.g. involving hazardous materials, substances and mixtures) (HSE, 2007).

Health and Safety File

The health and safety file needs to cover issues that will help planning future construction work, including details of any hazardous materials used in constructing the project (for example lead paint; pesticides; special coatings which should not be burnt off etc.); and information required for the safe cleaning and maintenance of the asset (HSE, 2007).

2.3.3.4 Hazardous Waste Regulations:

Environment Agency (2014) states that a completed consignment note¹⁵ must accompany hazardous waste when moved from any premises to allow any subsequent holders to manage the waste safely in accordance with their Duty of Care. The waste producer must provide all of the following details for each different type of waste being collected, including but not limited to:

- a full description of the waste;
- the 6 digit List of waste code(s) for the waste;
- total weight in 'kg' for each hazardous List of waste code;
- chemical/biological components of the waste and their concentrations;
- physical form (gas, liquid, solid, powder, sludge or mixed);
- hazard code(s).

2.3.4 Legislation controlling the discharge of hazardous materials, substances and mixtures into the environment:

Defra (2013) confirms that the Environmental Permitting Regulations 2007 (as amended) address the Pollution Prevention and Control Regime which was originally introduced by the Environmental Protection Act 1990. The regime aims, amongst other things, to permit installations or mobile plant with a view to controlling the release of polluting substances into the air, water or land.

The most polluting of the installations (Part A1) are enforced by the Environment Agency, the less polluting (Part A2) are enforced by local authorities. Those installations with polluting potential to the air only (Part B) are enforced by local authorities.

¹⁵ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/300104/Consignment_note_LIT_6872.pdf

2.4 Summary of review findings

Project definition of what constitutes a hazardous material and substance

The regulatory review has identified that a material, article, substance or mixture is likely to be hazardous to human health and/or the environment where it contains a substance:

- That meets the criteria for classification as 'hazardous' according to the CLP Regulation, or (until 1 June 2015) 'dangerous' according to the Dangerous Substances Directive 67/548/EEC or Dangerous Preparations Directive, 1999/45/EC;
- Which is persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB), according to the criteria given in Annex XIII of the REACH Regulation;
- Included in the European Chemicals Agency's 'candidate list' of substances of very high concern (SVHC) for eventual authorisation according to Article 59 (1) of the REACH Regulation (including articles containing a SVHC on the candidate list in a concentration above 0.1% w/w);
- That has been assigned a Workplace Exposure Limit (WEL) for use with the COSHH Regulations;
- Classified as a 'priority substance' or 'priority hazardous substance' according to the Proposal for a Directive amending the Water Framework Directive (WFD) and Environmental Quality Standards (EQSD) (Directive 2008/105/EC) (COM(2011)876); or listed in the Environment Agency's Chemical Standards Database (covering statutory and non-statutory chemicals of concern);
- Which, at the end of its life, is likely to be classified as a hazardous waste according to the Waste Framework Directive and List of Wastes Decision (2000/532/EC);
- That is subject to notification under the Ionising Radiations Regulations 1999, Control of Artificial Optical Radiation at Work Regulations (AOR) 2010, or the Radioactive Substances Act 1993.

Identification of any relevant hazard categorisation information

The regulatory review has identified that the risks and hazards arising from hazardous materials, articles, substances and mixtures are predominately classified according to the following regulations:

- CLP Regulation;
- The Dangerous Substances Directive and Dangerous Preparations Directive (until 1 June 2015);
- The REACH Regulation;
- The Hazardous waste directive.

Potential sources of hazard information

The regulatory review has identified the following potential sources of information, regarding the use of hazardous materials, substances and mixtures, which are likely to be held by the HA's Major Project Teams, Managing Agent Contractors (MAC) and Design, Build, Finance and Operate Companies (DBFO):

- REACH Safety Datasheets received from material suppliers;
- COSHH risk assessments and safety method statements prepared by the contractor;
- Construction Phase Plans and Health and Safety Files (required for any project notified under CDM);
- Site Waste Management Plans and/or Hazardous Waste Consignment Notes;
- Records of any ionising and nonionising radiation sources notified under the Ionising Radiations Regulations 1999, Control of Artificial Optical Radiation at Work Regulations (AOR) 2010 or the Radioactive Substances Act 1993;
- Records of any environmental permits registered with the Environment Agency or Local Authority for the treatment or use of hazardous materials in construction (e.g. asphalt waste containing tar);

- Records of any construction health and safety incidents and/or pollution events involving the use of hazardous materials, substances or mixtures in the course of delivering HA services.

A number of the HA delivery partners use the Alcumus Sypol CMS system (COSHH Assessment and Management Software) to generate COSHH assessments. The Sypol system gives the delivery partners access to a library of over 500,000 substances and work practices which can be used as the building blocks for completing project specific COSHH assessments. If a work practice isn't available, the Sypol team will write a new one. The delivery partners provide the material details and exposure scenario information to Sypol who then issue a completed COSHH Assessment. Each subscriber, to the Sypol system, has their own work area where their completed COSHH Assessments are filed according to subscribers requirements. The system can be searched by project and by hazard rating.

The sources of hazard information, identified above, have been used to support the development of data requests to the HA and their delivery partners. Though it should be noted this list of information was subsequently reduced and rationalised in order to reduce the administrative burden on the HA's delivery partners. The project team also explored sourcing this information directly from the Sypol CMS system. However, discussions with the Alcumus Group confirmed that the delivery partners work areas (on the Sypol system) could only be accessed if each of the delivery partner had a spare read only user license. Given the inherent risks with this method of data collection (i.e. some contractors may have had spare licences, others may have not), and the financial / administrative implications attached to gaining new licenses, it was considered preferable for the HA delivery partners to supply this information directly to the project team.

3 Identifying hazardous materials, substances and mixtures

A two stage data collection process was employed to identify the purchased materials, substances and mixtures currently being used by the HA delivery partners in highway construction, maintenance, operation and decommissioning.

Initially a data request was made to nine of the HA delivery partners¹⁶ who were asked to provide a comprehensive list of any materials, substances or mixtures currently used to deliver HA services that they considered hazardous to human health or the environment.

Positive responses were received from four of the delivery partners. One response included a full list of all materials, substances and mixtures used in delivering HA services by the company, whereas the other three provided scheme specific data from two bridge maintenance schemes, one junction improvement scheme, two motorway smart all lane running schemes and one unspecified maintenance scheme on the M3 motorway.

Subsequently those delivery partners who responded to the first request were asked to supply the COSHH Assessments and Chemical Exposure Scenario Forms for each of the substances and mixtures identified in their initial response. This information was requested in order to identify a number of characteristics, including:

- the typical method of application / exposure;
- the length of time exposed;
- the frequency of use; and
- the quantity used.

However, only two responses were received to this data request.

¹⁶ This list was chosen by the HA H&S Lead to reflect both the Major Projects and MAC communities.

4 Screening and prioritising the identified materials, substances and mixtures

The consultation exercise generated an extensive list of over 220 materials, this was subsequently reduced to 146 distinct products once duplicate entries had been removed from the dataset. The significant amount of duplication, across these projects, potentially suggests a high degree of standardisation in the types of products used on highway schemes.

Information on frequency and quantity of use has only been recorded for 34 of these materials, substances and mixtures due to the low response rate to the second stage of the data collection exercise and owing to the fact that not all COSHH assessments have recorded this level information.

A screening matrix has been developed, by the project team, which has been used to record the following parameters for each product (where available) in order to evaluate the hazards / risks that these materials, substances and mixtures pose to human health and the environment. These parameters have been sourced from a combination of supplier Safety Data Sheets (Items 1 to 9) and COSHH Risk Assessments (Items 14 to 17):

1. Product category (e.g. grout, sealant etc.)
2. Identified use / function in delivering HA services;
3. Composition / information on hazardous ingredients;
4. Physical and chemical properties (e.g. solid, liquid, gas etc.);
5. Stability and reactivity;
6. CLP Hazard Class, Category and Signal Word¹⁷;
7. Physical hazards;
8. Toxicological hazards;
9. Environmental hazards;
10. Receptor(s);
11. Physical Hazard Rating;
12. Health Hazard Rating;
13. Environmental Hazard Rating;
14. Overall hazard rating (based on worst case Signal Word);
15. Method of application / exposure;
16. Frequency of use;
17. Length of time exposed;
18. Typical quantity of substance used by one person in one day;
19. Volume used in delivering HA services (Low, Medium, High).

The first two parameters are used to identify and categorise the materials, substances and mixtures. Items 6 to 9 are used to record the classification of the hazards from Supplier Safety Data Sheets, with Items 3 to 5 and 10 providing supporting information on this hazard classification. Based on the hazard classification information recorded the project has assigned a hazard rating in Items 11 to 14 of the matrix, the process for assigning this rating is explained below. The remaining items 15 to 19 are intended to be used to develop a method for prioritising the materials, substances and mixtures based on the potential frequency of use and exposure.

A hazard rating system has been applied, using the CLP hazard classes and signal words (Danger, Warning, or Not Required), to assign a RED, AMBER, YELLOW¹⁸ hazard rating to each product relative to its physical, health and environmental hazards (Items 10-13):

¹⁷ The conversion tables from classification under the Dangerous Substances Directive to classification and assignment of hazard statements under CLP, found in Appendix C, have been used to ensure that any hazards reported in safety datasheets using the older hazard classification system have been converted to those used by the CLP / CHS.

¹⁸ The use of GREEN was avoided to prevent any confusion regarding the classification of these materials, substances or mixtures. I.e. the use of GREEN may have wrongly signified that a material was devoid of any ingredients that could cause harm to human health or the environment.

- A Red (High) hazard rating has been assigned when a material, substance or mixture has one or more hazard classes that are signalled with “Danger” under CLP;
- An Amber (Medium) hazard rating has been assigned when a material, substance or mixture has one or more hazard classes that are signalled with “Warning” under CLP or which are classified under CLP but no signal word is required (e.g. some environmental hazard classes as explained below);
- A Yellow (Low) hazard rating has been assigned when a material, substance or mixture contains hazardous ingredients but at insufficient concentrations for it to be regarded as a health or environmental hazard under CLP.

Only products which are classified as ‘Very toxic to aquatic life’, ‘Very toxic to aquatic life with long lasting effects’ or ‘Hazardous To The Ozone Layer’ are assigned a “Warning” signal word under the CLP. All other lower level hazard categories are not assigned a signal word. In order to ensure that any product that is environmentally hazardous is given an appropriate weighting in the screened dataset, an Amber (Medium) hazard rating has been assigned when a material, substances or mixture has one or more hazard classes that are signalled with “Warning” under the CLP or which are classified under CLP but no signal word is required (e.g. some chronic aquatic toxicity hazard classes).

An overall RED, AMBER, YELLOW hazard rating has then been given to each product based on the worse case rating of each of its individual physical, health or environmental hazards. This in combination with the individual physical, health and environmental hazard ratings has been used to highlight the degree of hazard posed by each material, substance or mixture (Item 13).

Due to the limited data received on the prioritisation parameters of quantity and frequency of use and exposure it has not been possible for this project to develop a prioritisation method, however, Section 5 does identify products of potential concern based on the data received.

5 Conclusions

The project screening matrix clearly identifies how each material or substance is used on the HA network, the properties that make it hazardous, the level of exposure to these receptors (where this information is available) and the degree of hazard posed to human health / environmental receptors.

The screening matrix has assigned a hazard rating to each material or substance relative to its physical, health and environmental hazards; and assigns an overall RED, AMBER, YELLOW hazard rating based on the worse case rating of each of its individual physical, health or environmental hazards. These rating have been used to generate a list of 60 materials which, based on the information received from the HA delivery partners, are likely to present the greatest degree of Hazard to human health and the environment.

The materials, substances and mixtures identified include: asphalt (bituminous and tar bound) materials; cement, concrete, mortars and grouts; adhesives; sealants; oils and fuels; lubricants; line marking paints, de-icers, cleaning and stationery products. All of these products have one or more physical or human health hazards classes that have been assigned a “Danger” signal word under CLP, i.e. those materials, substances and mixtures with the most severe hazards:

- 22 of these products are considered to be hazardous solely because of their physical hazards (i.e. flammable or explosive properties);
- 35 of these products are considered to be hazardous solely because of human health hazards; with three of these products containing the following substances that are included in the European Chemicals Agency’s ‘Candidate List’ of SVHC, i.e. sodium peroxometaborate (toxic for reproduction), benzyl butyl phthalate (toxic for reproduction) and pitch, coal tar, high temp (carcinogenic, PBT and vPvB);
- 3 of these products are considered to be hazardous due to a combination of physical and human health hazards.

In addition, 19 of these products also present chronic hazards to the aquatic environment; though as these are lower level hazard categories they are not assigned a signal word under CLP. Nevertheless, it is these products, which due to having properties which make them hazardous to both human health and the aquatic environment, are likely to be of principal interest to the HA and we would conclude at this stage merit further attention.

However, it has not been possible, during this commission, to identify those materials, substances and mixtures that are deemed to present the greatest potential 'Risk' to human health or the environment (i.e. those hazardous products which are used the most frequently and in the largest quantities in delivering HA services) due to the limited information received from the HA delivery partners on frequency and quantity of use. For example, a RED rated product used, infrequently and in low quantities may present a less significant risk, to human health and/or the environment, than an AMBER rated product that is used frequently and in large quantities.

6 Limitations

The materials, substances and mixtures identified during this project have been sourced through direct consultation with a sample of the HA delivery partners. As such the list of materials, substances is likely to be somewhat dependent on the nature of work currently being undertaken by these parties and the quality of data records. The data collected as part of this project should therefore not be considered a comprehensive list of all hazardous substances used in the delivery of HA services. In addition, the level of information included in the initial draft of the supplier data request was subsequently rationalised / reduced, on the instructions of the client, in order to reduce the burden on the HA's delivery partners.

A hazard rating system has been developed, as part of this project, that uses the European Regulation on Classification, Labelling and Packaging of Substances and Mixtures (CLP Regulation) to assign a RED, AMBER, YELLOW hazard rating to each material, substance or mixture. This has been used to highlight the degree of hazard posed by each material, substance or mixture relative to its physical, health and environmental hazards.

However, it has not been possible during this commission to identify those substances that present the greatest potential risk to human health or the environment in delivering HA services (i.e. those hazardous products which are used the most frequently and in the largest quantities) due to the limited information received from the HA delivery partners on frequency and quantity of use.

7 Recommendations for further work

This study has developed a screening matrix method to aid the classification of hazardous materials used in constructing, maintaining and managing the HA network. The data responses received have been used to test this methodology, however this has been limited in scope and further work is required to fully understand the use of hazardous materials, substances and mixtures by the HA's delivery partners and their sub-contractors.

Further work is recommended in order to develop a prioritised list of materials, substances and mixtures for the HA to focus on in the short, medium and long term, based on the level of risk and potential to avoid or substitute. This is likely to require targeted engagement with the HA delivery partners, manufacture of the substances and relevant trade associations, as well as relevant health, safety and environmental experts. Further work is recommended in order to:

- a) Confirm a comprehensive list of materials, substances, or mixtures that are hazardous to human health and the environment used in delivering HA services recognising that the data collection exercise undertaken as part of this project has only developed a partial data set.
- b) Obtain data on the quantity of the materials, substances and mixtures, identified in the screening matrix, that are currently used in delivering HA services (e.g. X litres/year etc.), the method of

application, the number of staff directly involved (on average), the length of time exposed and existing control measures. This will enable a risk based process of prioritisation to be completed.

- c) Engage with delivery partners, trade organisations, suppliers and other client organisations to develop a priority list of 'materials, substances and mixtures of concern' to focus industry efforts on seeking options for eliminating their use or substitution opportunities.
- d) Work with delivery partners to confirm when the most significant risks occur – construction, operation, maintenance or decommissioning with specific materials. Confirm steps taken by users to remove or mitigate risks to health and environment.
- e) Identify where the use of a given material or substance can be avoided (e.g. where working methods or design standards can be changed) and change policies and standards to mandate, or encourage, delivery partners and their subcontractors to avoid the use of specific materials, substances or mixtures. Seek industry collaboration to encourage a change in practice.
- f) Where less hazardous alternatives exist investigate whether these are viable and to what degree the delivery partners have explored seeking safer alternatives.
- g) Where avoiding or substituting a material, substance or mixture that is of particular concern is not currently possible or viable, consider supporting research, collaborating across the industry to address this.

The majority of the delivery partners consulted during this commission use the Alcumus Sypol CMS system to generate COSHH assessments. The HA delivery partners provide the material details and exposure scenario information to Sypol who then issue a completed COSHH Risk Assessment. The delivery partners are asked, when completing the exposure scenario form, whether the elimination or substitution of the material has been considered and the reason for leaving / swapping the material. Obtaining direct access to this information may therefore prove useful in terms of completing the further work and research identified above.

We also advise that the findings from this initial work be disseminated and discussed at appropriate internal HA forums / working groups focusing on health and environmental matters. We also understand that the HA plan to undertake more work on sustainability and its supply chain in particular a review of supply chain practices associated with key materials. It may be that further work in the supply chain area could support further research in this study and vice versa, in particular potentially the manufacture and use of SVHC (REACH) substances used in the supply chain.

It is also recommended that any further work makes reference to the International Chemicals Secretariats (ChemSec) SIN (Substitute It Now!) List. This lists chemicals that ChemSec has identified as Substances of Very High Concern based on the criteria established by REACH. The aim of the SIN List is to spark innovation towards products without hazardous chemicals by speeding up the REACH processes as well as offering a glimpse into the possible future of European chemicals regulation. By doing so, it is likely to be a useful tool for the HA for chemical hazard assessment and chemical and product prioritisation.

ChemSec have also introduced a SINimilarity tool, to complement the SIN List, which aims to make it easier to avoid non-sustainable and regrettable substitution (e.g. substituting problematic chemicals with those that have later been shown to have similar hazardous properties as the problematic chemicals they replaced). The SINimilarity tool can be used to find out how similar one out of 80,000 chemicals in the reference database is to the substances on the SIN List, with any chemicals that are similar to the SIN List chemicals requiring further investigations before use.

8 References

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- Regulation of the European Parliament and of the Council on the Classification, Labelling and Packaging of Substances and mixtures, Amending and Repealing Directives 67/548/EEC AND 1999/45/EC, and Amending Regulation (EC) No 1907/2006, ANNEX III List of Hazard Statements, supplemental hazard information and supplemental label elements.
http://ec.europa.eu/enterprise/sectors/chemicals/files/ghs/w_annex_iii_en.doc

Appendix A - List of harmonised classification and labelling of hazardous substances (CLP)

Appendix B - List of harmonised classification and labelling of hazardous substances (DSD)

Appendix C - Translation from classification under DSD to classification under CLP

Appendix D - CLP Hazard (H) and Precautionary (P) Statements

H200-Series: Physical hazards:

H200 Unstable explosive
H201 Explosive; mass explosion hazard
H202 Explosive; severe projection hazard
H203 Explosive; fire, blast or projection hazard
H204 Fire or projection hazard
H205 May mass explode in fire
H220 Extremely flammable gas
H221 Flammable gas
H222 Extremely flammable material
H223 Flammable material
H224 Extremely flammable liquid and vapour
H225 Highly flammable liquid and vapour
H226 Flammable liquid and vapour
H228 Flammable solid
H240 Heating may cause an explosion
H241 Heating may cause a fire or explosion
H242 Heating may cause a fire
H250 Catches fire spontaneously if exposed to air
H251 Self-heating; may catch fire
H252 Self-heating in large quantities; may catch fire
H260 In contact with water releases flammable gases which may ignite spontaneously
H261 In contact with water releases flammable gas
H270 May cause or intensify fire; oxidizer
H271 May cause fire or explosion; strong oxidizer
H272 May intensify fire; oxidizer
H280 Contains gas under pressure; may explode if heated
H281 Contains refrigerated gas; may cause cryogenic burns or injury
H290 May be corrosive to metals

H300-Series: Health hazards:

H300 Fatal if swallowed
H301 Toxic if swallowed
H302 Harmful if swallowed
H304 May be fatal if swallowed and enters airways
H310 Fatal in contact with skin
H311 Toxic in contact with skin
H312 Harmful in contact with skin
H314 Causes severe skin burns and eye damage
H315 Causes skin irritation
H317 May cause an allergic skin reaction
H318 Causes serious eye damage
H319 Causes serious eye irritation
H330 Fatal if inhaled
H331 Toxic if inhaled
H332 Harmful if inhaled
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled
H335 May cause respiratory irritation
H336 May cause drowsiness or dizziness

H340 May cause genetic defects, (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)

H341 Suspected of causing genetic defects (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)

H350 May cause cancer May cause cancer (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)

H350i May cause cancer by inhalation

H351 Suspected of causing cancer (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)

H360 May damage fertility or the unborn child (state specific effect if known)(state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)

H360F May damage fertility

H360D May damage the unborn child

H360FD May damage fertility. May damage the unborn child

H360Fd May damage fertility. Suspected of damaging the unborn child

H360Df May damage the unborn child. Suspected of damaging fertility

H361 Suspected of damaging fertility or the unborn child (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)

H361f Suspected of damaging fertility.

H361d Suspected of damaging the unborn child.

H361fd Suspected of damaging fertility. Suspected of damaging the unborn child

H362 May cause harm to breast-fed children

H370 Causes damage to organs (or state all organs affected, if known) (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)

H371 May cause damage to organs (or state all organs affected, if known) (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)

H372 Causes damage to organs through prolonged or repeated exposure (state all organs affected, if known) through prolonged or repeated exposure (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)

H373 May cause damage to organs through prolonged or repeated exposure (state all organs affected, if known) through prolonged or repeated exposure (state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard)

H400: Environmental hazards:

H400 Very toxic to aquatic life

H410 Very toxic to aquatic life with long lasting effects

H411 Toxic to aquatic life with long lasting effects

H412 Harmful to aquatic life with long lasting effects

H413 May cause long lasting harmful effects to aquatic life

EUH-Statements (carried through from DSD and DPD, but which are not yet included in the CLP):

EUH001 Explosive when dry

EUH006 Explosive with or without contact with air

EUH014 Reacts violently with water

EUH018 In use may form flammable/explosive vapour-air mixture

EUH019 May form explosive peroxides

EUH044 Risk of explosion if heated under confinement

EUH029 Contact with water liberates toxic gas

EUH031 Contact with acids liberates toxic gas

EUH032 Contact with acids liberates very toxic gas

EUH066 Repeated exposure may cause skin dryness or cracking

EUH070 Toxic by eye contact

EUH071 Corrosive to the respiratory tract

EUH059 Hazardous to the ozone layer

EUH201 Contains lead. Should not be used on surfaces liable to be chewed or sucked
EUH201A Warning! Contains lead
EUH202 Cyanoacrylate. Danger. Bonds skin and eyes in seconds. Keep out of the reach of children
EUH203 Contains chromium (VI). May produce an allergic reaction
EUH204 Contains isocyanates. May produce an allergic reaction
EUH205 Contains epoxy constituents. May produce an allergic reaction.
EUH206 Warning! Do not use together with other products. May release dangerous gases (chlorine)
EUH207 Warning! Contains cadmium. Dangerous fumes are formed during use. See information supplied by the manufacturer. Comply with the safety instructions
EUH208 Contains <name of sensitising substance>. May produce an allergic reaction
EUH209 Can become highly flammable in use
EUH209A Can become flammable in use
EUH210 Safety data sheet available on request
EUH401 To avoid risks to human health and the environment, comply with the instructions for use

P100-Series: General:

P101 If medical advice is needed, have product container or label at hand.
P102 Keep out of reach of children.
P103 Read label before use.

P200-Series: Prevention:

P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
P211 Do not spray on an open flame or other ignition source.
P220 Keep/Store away from clothing/.../combustible materials.
P221 Take any precaution to avoid mixing with combustibles...
P222 Do not allow contact with air.
P223 Keep away from any possible contact with water, because of violent reaction and possible flash fire.
P230 Keep wetted with...
P231 Handle under inert gas.
P232 Protect from moisture.
P233 Keep container tightly closed.
P234 Keep only in original container.
P235 Keep cool.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ventilating/lighting/.../equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P244 Keep reduction valves free from grease and oil.
P250 Do not subject to grinding/shock/.../friction.
P251 Pressurized container: Do not pierce or burn, even after use.
P260 Do not breathe dust/fume/gas/mist/vapours/spray.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P262 Do not get in eyes, on skin, or on clothing.
P263 Avoid contact during pregnancy/while nursing.
P264 Wash ... thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P272 Contaminated work clothing should not be allowed out of the workplace.
P273 Avoid release to the environment.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P281 Use personal protective equipment as required.
P282 Wear cold insulating gloves/face shield/eye protection.

P283 Wear fire/flame resistant/retardant clothing.
P284 Wear respiratory protection.
P285 In case of inadequate ventilation wear respiratory protection.
P231+ P232 Handle under inert gas. Protect from moisture.
P235 + P410 Keep cool. Protect from sunlight.

P300-Series: Response:

P301 IF SWALLOWED:
P302 IF ON SKIN:
P303 IF ON SKIN (or hair):
P304 IF INHALED:
P305 IF IN EYES:
P306 IF ON CLOTHING:
P307 IF exposed:
P308 IF exposed or concerned:
P309 IF exposed or if you feel unwell:
P310 Immediately call a POISON CENTER or doctor/physician.
P311 Call a POISON CENTER or doctor/physician.
P312 Call a POISON CENTER or doctor/physician if you feel unwell.
P313 Get medical advice/attention.
P314 Get medical advice/attention if you feel unwell.
P315 Get immediate medical advice/attention.
P320 Specific treatment is urgent (see ... on this label).
P321 Specific treatment (see ... on this label).
P322 Specific measures (see ... on this label).
P330 Rinse mouth.
P331 Do NOT induce vomiting.
P332 If skin irritation occurs:
P333 If skin irritation or rash occurs:
P334 Immerse in cool water/wrap in wet bandages.
P335 Brush off loose particles from skin.
P336 Thaw frosted parts with lukewarm water. Do not rub affected area.
P337 If eye irritation persists:
P338 Remove contact lenses, if present and easy to do. Continue rinsing.
P340 Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P341 If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
P342 If experiencing respiratory symptoms:
P350 Gently wash with plenty of soap and water.
P351 Rinse cautiously with water for several minutes.
P352 Wash with plenty of soap and water.
P353 Rinse skin with water/shower.
P360 Rinse immediately contaminated clothing and skin with plenty of water before removing clothes.
P361 Remove/Take off immediately all contaminated clothing.
P362 Take off contaminated clothing and wash before reuse.
P363 Wash contaminated clothing before reuse.
P370 In case of fire:
P371 In case of major fire and large quantities:
P372 Explosion risk in case of fire.
P373 DO NOT fight fire when fire reaches explosives.
P374 Fight fire with normal precautions from a reasonable distance.
P375 Fight fire remotely due to the risk of explosion.
P376 Stop leak if safe to do so.
P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.

P378 Use ... for extinction.
P380 Evacuate area.
P381 Eliminate all ignition sources if safe to do so.
P390 Absorb spillage to prevent material damage.
P391 Collect spillage.
P301+ P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P301+ P312 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
P301+ P330+ P331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P302 + P334 IF ON SKIN: Immerse in cool water/wrap in wet bandages.
P302+ P350 IF ON SKIN: Gently wash with plenty of soap and water.
P302+ P352 IF ON SKIN: Wash with plenty of soap and water.
P303+ P361+ P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P304 + P341 IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if P338 present and easy to do. Continue rinsing.
P306 + P360 IF ON CLOTHING: rinse immediately contaminated clothing and skin with plenty of water before removing clothes.
P307 + P311 IF exposed: Call a POISON CENTER or doctor/physician.
P308 + P313 IF exposed or concerned: Get medical advice/attention.
P309 + P311 IF exposed or if you feel unwell: Call a POISON CENTER or doctor/physician.
P332+ P313 If skin irritation occurs: Get medical advice/attention.
P333+ P313 If skin irritation or rash occurs: Get medical advice/attention.
P335 + P334 Brush off loose particles from skin. Immerse in cool water/wrap in wet bandages.
P337 + P313 If eye irritation persists: Get medical advice/attention.
P342+ P311 If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
P370+ P376 In case of fire: Stop leak if safe to do so.
P370+ P378 In case of fire: Use ... for extinction.
P370+ P380 In case of fire: Evacuate area.
P370+ P380+ P375 In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.
P371+ P380+ P375 In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.

P400-Series: Storage:

P401 Store ...
P402 Store in a dry place.
P403 Store in a well-ventilated place.
P404 Store in a closed container.
P405 Store locked up.
P406 Store in corrosive resistant/... container with a resistant inner liner.
P407 Maintain air gap between stacks/pallets.
P410 Protect from sunlight.
P411 Store at temperatures not exceeding ... °C/... °F.
P412 Do not expose to temperatures exceeding 50 °C/122 °F.
P413 Store bulk masses greater than ... kg/... lbs at temperatures not exceeding ... °C/... °F.
P420 Store away from other materials.
P422 Store contents under ...
P402+ P404 Store in a dry place. Store in a closed container.
P403+ P233 Store in a well-ventilated place. Keep container tightly closed. P403+
P235 Store in a well-ventilated place. Keep cool.
P410+ P403 Protect from sunlight. Store in a well-ventilated place.

P410+ P412 Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F.

P411+ P235 Store at temperatures not exceeding ... °C/... °F. Keep cool.

P500-Series: Disposal:

P501 Dispose of contents/container to