



Undisclosed chemicals – implications for risk assessment: A case study from the mining industry



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ABSTRACT

Many of the chemicals used in industry can be hazardous to human health and the environment, and some formulations can have undisclosed ingredients and hazards, increasing the uncertainty of the risks posed by their use. The need for a better understanding of the extent of undisclosed information in chemicals arose from collecting data on the hazards and exposures of chemicals used in typical mining operations (copper, platinum and coal). Four main categories of undisclosed chemicals were defined (incomplete disclosure; chemicals with unspecific identities; relative quantities of ingredients not stated; and trade secret ingredients) by reviewing material safety data sheet (MSDS) omissions in previous studies. A significant number of chemicals (20% of 957 different chemicals) across the three sites had a range of undisclosed information, with majority of the chemicals (39%) having unspecific identities. The majority of undisclosed information was found in commercially available motor oils followed by cleaning products and mechanical maintenance products, as opposed to reagents critical to the main mining processes. All three types of chemicals had trade secrets, unspecific chemical identities and incomplete disclosures. These types of undisclosed information pose a hindrance to a full understanding of the hazards, which is made worse when combined with additional MSDS omissions such as acute toxicity endpoints (LD₅₀) and/or acute aquatic toxicity endpoints (LC₅₀), as well as inadequate hazard classifications of ingredients. The communication of the hazard information in the MSDSs varied according to the chemical type, the manufacturer and the regulations governing the MSDSs. Undisclosed information can undermine occupational health protection, compromise the safety of workers in industry, hinder risk assessment procedures and cause uncertainty about future health. It comes down to the duty of care that industries have towards their employees. With a wide range of chemicals increasingly used, there is a balance that needs to be reached between disclosure requirements, trade secret provisions and definitions of hazardous ingredients for market needs, and the information required to protect the health of their workers.

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1. Introduction

Many of the chemicals used in industry and consumer products can be hazardous to human health and the environment and the majority have yet to be tested for potential toxicity and impact on human diseases (Haynes, 2010). There is relatively little information on chemical constituents in many types of products such as personal care products

and fragrances, and of those used in industry including cleaning agents, paints, lubricants, adhesives, pesticides, motor oils and dispersants. Usually ingredients and their hazards in chemical formulations are communicated to workers and consumers through material safety data sheets (MSDSs). These are documents provided with chemicals, as a guide for workers on the safe handling and use of the substances. The minimum requirements for the section on the composition/information on ingredients for MSDSs for mixtures, as documented by the UN Globally Harmonised System (UN GHS) are that: the ingredients are listed with their CAS numbers (or other identification number); full chemical name and concentration of all ingredients which are classified as a health hazard. There is however a significant percentage of chemicals in which some ingredients and their hazards are undisclosed, increasing uncertainty associated with their use. Steinemann (2009) defined undisclosed ingredients as chemicals in products that may not be identified through information provided to the public or regulatory services. Undisclosed information can undermine occupational health protection, compromise the safety of workers in industry, hinder risk assessment procedures and lead to uncertainty about future health.

Abbreviations: CAS, Chemical abstract service; CBI, Confidential business information; CLP, Classification, labelling, packaging; CMR, Carcinogenic, mutagenic, reproductive toxin; ECHA, European chemicals agency; EPA, US Environmental Protection Agency; FIFRA, US Federal Insecticide, Fungicide, and Rodenticide Act; GHS, United nations globally harmonised system of classification and labelling of chemicals; IARC, International Agency for Research on Cancer; IDS, Ingredient data sheet; LC50, Lethal concentration 50%; LD50, Lethal dose 50%; MSDS, Material safety data sheet; PFOS, Perfluorooctane sulphonate; POP, Persistent organic pollutant; PPE, Personal protection equipment; REACH, Registration, evaluation, authorisation and restriction of chemicals; TSCA, Toxic Substances Control Act; VCCEP, Voluntary Children's Chemical Evaluation Program; VOCs, Volatile organic compounds; WHMIS, Workplace Hazardous Materials Information System.

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Several previous studies have identified undisclosed ingredients in a range of consumer products and the issues associated with withholding information about ingredients in MSDSs have centred on the risk of injury to users as a result of inadequate hazard communication (Kolp et al., 1995; Welsh et al., 2000). This can be a barrier to chemical risk assessment procedures that should consider both the hazards and exposures to determine the overall risk posed by the chemicals. If this assessment is carried out at a company level, the first point of reference about the chemical hazards would be the MSDSs. It is important therefore that this source of information is complete and accurate, especially when the formulations in question are multi-component substances. The information in MSDSs is also important to the exposure assessment process and to monitor if the exposure limits of the ingredients listed in the MSDSs are adhered to. The MSDS regulations in different countries do not require the manufacturer to disclose ingredients regarded as non-hazardous, and procedures have always been in place for business confidentiality claims. Nevertheless, chemical legislation is being tightened globally, as the considerable extent of the health and safety risks associated with exposure to chemical products is recognised. Mining operations use a wide range of different chemicals from specialist chemicals to those that are commercially available and with hazard classifications that range from known carcinogens to non-classifiable. The use patterns range from milligrammes per month to tonnes per day; and chemical exposure controls vary from local exhaust ventilation to the use of personal protection equipment (PPE). Mining companies are frequently multinational organisations and have to comply with different chemical legislations and different MSDSs. The mining industry is therefore an ideal case study to understand how undisclosed information in MSDSs hinders chemical risk assessments.

This work considered three different mine site commodities – copper, platinum and coal in order to understand the range of undisclosed chemicals used in their operations. These range from flotation reagents to separate ore minerals from gangue; oils, greases and lubricants in machinery maintenance; laboratory chemicals for analysis; explosives in the mines; and agricultural, gardening to cleaning products for the general maintenance of sites. Therefore, it focuses on the mining industry to evaluate the significance of undisclosed information in the chemical risk assessment process; and identify the impact on chemical management and the key issues faced by companies protecting their workers from uncertain chemical risks. This paper also reviewed previous studies of undisclosed ingredients, considered examples of how undisclosed, incomplete and inaccurate information can cause injury to human health and/or the environment, and examined chemical regulations that affect confidential business information (CBI) and MSDSs in a few key countries where there are mining activities.

2. Review of literature on previous MSDS deficiencies

It is widely accepted that trade secrecy undermines risk management, as it transfers the health and safety options from those who are exposed to those who profit. Secrecy also subsidises existing technologies, disguising their costs, and suppressing incentives to develop better ones (Lyndon, 2011). A range of consumer products contain undisclosed information, including fragranced products (such as air fresheners, laundry supplies and cleaners), paint thinner products, synthetic lubricants, detergents and oil dispersants. These studies have evaluated the chemical identification of ingredients provided in the MSDSs and some of the key omissions have been outlined as follows:

- The use of ranges instead of specific quantities of ingredients, which makes estimating the total amount of specific ingredients difficult (Winder and Ng, 1995) and creates uncertainty about dose and exposure (Schmidt, 2010).
- Failure to disclose any hazardous ingredients in the MSDS despite hazard inferences in statements about health effects, first aid and

personal protection equipment (PPE) recommendations (Kolp et al., 1995; Welsh et al., 2000).

- The use of nonspecific chemical names, such as the use of a chemical family or class (Kolp et al., 1995; Winder and Ng, 1995).
- MSDSs with ingredients listed as trade secrets, which are exempt from public disclosure (Kolp et al., 1995; Steinemann, 2009; Winder and Ng, 1995).
- Ingredients regulated as toxic or hazardous under federal law in the USA, identified through chemical analysis, but were not disclosed in the MSDSs of fragranced consumer products (Steinemann, 2009).
- The failure of some MSDSs to adequately describe the known reproductive toxicity effects of some chemicals (Paul and Kurtz, 1994; Welsh et al., 2000).

Although information about chemical hazards has now become more accessible to the public, and consumers can make more informed choices about the products they choose, chemical legislation globally is still trying to find a balance between adequately informing the public of hazards and maintaining the competitiveness of the chemical industry by protecting business confidentiality. The main focus of each study, the country in which the study was conducted, the relevant MSDS and the conclusions are summarised in chronological order in Table 1.

2.1. Inadequate hazard communication

Inadequate hazard communication is one of the issues associated with undisclosed information about chemicals. Previous work on the accuracy of MSDSs (Kolp et al., 1995) evaluated five areas of information: chemical identification of hazardous ingredients; reported health effects; necessary first aid procedures; appropriate personal protective equipment; regulations and guidelines on workplace exposure levels. In terms of the chemical identification of hazardous ingredients, it was concluded that without specific chemical names, no evaluation of the accuracy of the material presented could be undertaken. Without knowing what chemical(s) was/were being addressed by the MSDS, it is impossible to evaluate whether the information presented is correct (Kolp et al., 1995).

The inaccurate listing of ingredients in MSDSs can lead to insufficient recommendations for personal protection which could compromise the safety of the workers and undermine injury prevention (Welsh et al., 2000). Welsh et al (2000) presented results for three cases in which MSDS ingredient disclosures were incomplete. The products included a synthetic lubricant used in a mining operation, a detergent concentrate used for aircraft cleaning and an epoxy reducer used in aircraft maintenance. In each case, undisclosed hazardous ingredients were detected at concentrations which required disclosure. An evaluation of the MSDSs indicated that a proportion failed to disclose any hazardous ingredients despite hazard inferences from other sections of the MSDSs including adverse health effects, first aid and PPE recommendations.

Paul and Kurtz (1994) analysed the reproductive health hazard descriptions on nearly 700 MSDSs for products containing lead or ethylene glycol ether. The results showed that over 62% of the MSDSs made no reference to effects on the reproductive system (Paul and Kurtz, 1994). It was concluded that the information provided to employers and workers about reproductive and developmental risks was grossly inadequate and much greater efforts are needed to ensure that the health protective intent of right-to-know legislation in the USA is realised (Paul and Kurtz, 1994).

2.2. The misconception amongst workers that all similar types of chemical products are equivalent

Paint thinners can vary significantly, because of the variation in the proportion of ingredients they contain, including solvent classes. Winder and Ng (1995) evaluated 20 proprietary thinners using MSDSs, as part of a multidisciplinary study on solvent exposure and

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