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History and evolution of warning labels for automotive friction products

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ABSTRACT

There have been claims over the years that asbestos-containing product manufacturers did not sufficiently warn end users early enough regarding the potential health hazards associated with their products (1930s–1990s). To address this issue, we compared the content of the warnings associated with asbestos-containing friction products (brakes, clutches, and gaskets) manufactured by the US automotive industries to what was expected by regulatory agencies during the time period in which an understanding of asbestos health hazards was being developed. We ended our evaluation around 1990, since asbestos-containing manufacturer supplied automotive products were functionally removed from commerce by 1985 in the United States. We assessed the warnings issued in users' manuals, technical service bulletins, product packaging materials, and labels placed on products themselves. Based on our evaluation, regulatory agencies had no guidelines regarding specific warning language for finished friction products, particularly when a product contained encapsulated asbestos fibers (i.e., modified by a bonding agent). Even today, federal regulations do not require labeling on encapsulated products when, based on professional judgment or sampling, user exposure is not expected to exceed the OSHA PEL. We concluded that, despite limited regulatory guidance, the US automotive industry provided adequate warnings with regards to its friction products.

1. Introduction

Warning signs or labels are intended to make people aware of the presence of a hazard, provide guidance as to how the hazard can be avoided, and provide information regarding the consequences of exposure to the hazard (Rousseau and Wogalter, 2006). Since the Pure Food and Drug Act of 1906, numerous federal regulations have been published which address hazard labeling of a variety of substances (e.g., food, poisons, insecticides, chemicals in general) (Ayres et al., 1998). Warning labels serve several roles. First, they allow individuals to make an informed decision before using or purchasing a product. Second, they aid in limiting exposure by providing information on how a substance or product should be handled (e.g., the need to wear rubber gloves while handling a hazardous chemical). Third, hazard warnings act as an intermediate policy between absence of regulation and more restrictive controls, such as product bans or character alterations (Viscusi, 1996). In addition to federal regulations, voluntary standards also exist for product labeling. Even though voluntary standards are not legally enforceable, they are generally offered by manufacturing associations, and often are a major factor in regulatory agency decisions. The first industry-specific voluntary standards for products other than substances such as foods, poisons, insecticides, and chemicals in general began appearing in the 1970s (Ayres et al., 1998).

Modern labeling requirements are overseen, in part, by the American National Standard Institute (ANSI) Z535 Committee on Safety Signs and Colors (ANSI, 1991). The purpose of the ANSI Z535 Committee is to "develop standards for the design, application, and use of signs, colors, and symbols intended to identify and warn against specific hazards and for other accident prevention purposes" (ANSI, 1991, p. iii). The origin of the current ANSI began with the standardization of safety colors in the American War Standard, which was developed by the War Department and approved by the American Standards Association (ASA) on July 16, 1945 (Peckham, 2006). Five subcommittees were created to update and write the following five standards: *Safety Color Code, Environmental and Facility Safety Signs, Criteria for Safety Symbols, Product Safety Signs and Labels*, and *Accident Prevention Tags*; some of these standards have been combined and updated with time (ANSI, 1991; NEMA, 2011) In 2006, a sixth subcommittee was created, *Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials* (ANSI, 2006b). Together, these six standards contain information specifying format, colors, and symbols for safety signs used in environmental and facility applications,

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in product and product literature applications, and in temporary safety tag and barricade tape applications (NEMA, 2011). The standards suggested by ANSI are not a requirement, but rather a guide to aid the manufacturer, consumer, and general public. The ANSI qualified that precautionary labels "cannot be expected to cover the complete information on the properties of a material or the complete details of its proper handling under all conditions" (ANSI, 1976, p. 7). The ANSI also stated that products that presented no hazard in normal handling or storage were not required to present a label (ANSI, 1976).

According to Wogalter et al. (2002), an effective warning label should contain four message components: (1) a word to attract attention; (2) hazard identification; (3) hazard prevention instructions; and (4) an explanation of the consequences following an exposure to the hazard.

Research conducted to evaluate warning label effectiveness can be generally divided into three categories: signal word, symbol, and text (McGrath, 2011). The ANSI identified three signal words that can be used to call for attention: danger, warning, and caution (McGrath, 2011). The description of each word is defined by the ANSI according to the perceived level of risk. 'DANGER' indicates a "hazardous situation which, if not avoided, will result in death or serious injury", 'WARNING' indicates a "hazardous situation which, if not avoided, could result in death or serious injury", and 'CAUTION' indicates "a hazardous situation which, if not avoided, could result in minor or moderate injury" (ANSI, 2007, p. 4). Although some studies have shown that perception of the three words may differ from the ANSI definitions, the ANSI recommendations can be a useful guideline. With regard to using a symbol, such as a pictorial or pictogram, interpretations of the symbol may differ based on cultural background. Lastly, text that contains an explicit warning, or those that contain specific information about the nature of the hazard, particularly those with a statement of consequences, have "improved warning label comprehension" and possible increased the perceived risk of these products (McGrath, 2011, p. 50).

Despite the expected benefits of warning labels, functionally, they may not ultimately insure protection of the user. First, the warning labels placed on products may not be read, or a user may not follow the label instructions. If that happens, the language and content of the warning would not reduce hazardous behavior or exposure risk (Viscusi, 1996). For example, research conducted on patient misinterpretation of prescription drug label instructions has shown that people with lower literacy rates have a higher rate of misunderstanding drug labels than do those with marginal or adequate literacy (Wolf et al., 2007). In a later study, Wolf et al. (2010) showed that using simplified text paired with icon labels improved warning interpretation among patients with marginal and low literacy rates. Furthermore, a warning label may be better understood by a worker if it is pointed out by a safety instructor during training (McGrath, 2011). Therefore, a warning should be viewed as a supplement to the safety program, rather than a sole substitute of it (Wogalter et al., 2006).

The adequacy of warnings has become a significant issue in personal injury and product liability litigation in the United States (Wogalter et al., 2006). The purpose of this review and analysis is to determine when and how warning labels associated with finished automotive friction products were first developed, and how they changed or expanded over time, and to examine what factors influenced their evolution. Based on our review of the available literature, there is no published manuscript that has specifically reviewed or evaluated warning labels on automotive friction products such as brakes and clutches. We evaluated these warnings in conjunction with the state-of-the-art knowledge of asbestos science, as well as with relevant legal and regulatory guideline development. The history of asbestos use in US automotive friction products, US regulatory guidelines with regards to asbestos and such products, and the development of the science associated with asbestos toxicity are well documented.

2. Method

A search for documents containing information on asbestos toxicology as it relates to friction products and the requirements for warning relevant employees and consumers of potential exposure and adverse health effects was conducted. Reference materials evaluated in this study included: (1) toxicological data from peer-reviewed published literature, conference abstracts, and meeting proceedings; (2) warning standards and guidelines described in textbooks, peer-reviewed published literature, industry publications, government documents; (3) regulatory guidelines presented in government documents; (4) examples of labels from friction products; and (5) various types of lawsuits mentioned in law reviews and legal meeting proceedings. Multiple databases and search engines (e.g., PUBMED, Web of Science, Medline, Lexis–Nexis) and public and university libraries were searched to identify relevant books and peer-reviewed literature. Regulatory-related information was identified and collected primarily from government and professional organization websites, as well as from books, reports, and other literature published by these organizations, such as the *Federal Register*. For the collection of actual warnings and labels for friction- and automotive-specific products, such as clutches and brakes, we reviewed corporate documents, service manuals, user manuals, technical service bulletins (TSBs), Material Safety Data Sheets (MSDSs), and package labels.

Results were reported chronologically. Each of the time periods included information on key asbestos-related scientific literature, suggestions or requirements for labeling set forth by professional organizations, advisory agencies, or the federal government, and examples of pertinent warning labels issued by automotive manufacturers.

3. Results

3.1. Part I: Regulatory requirements for asbestos-containing products, prior to the establishment of OSHA

3.1.1. 1930s and 1940s: No governmental regulation; initial development of guidelines

During the 20th century, the understanding of the toxicity and potency of asbestos fibers steadily increased. The first death of a worker that was alleged from inhalation exposure to asbestos was reported in 1900 and the event is commonly referred to as the "Montague Murray Case" (Merewether and Price, 1930, p. A3). Shortly thereafter, although not as a result of this case report, animal experiments were conducted by Professor J.M. Beattie, which revealed that inhaling asbestos dust correlated with a mild degree of fibrosis in animals (Merewether and Price, 1930). In 1930, Merewether and Price conducted a study of workers in a textile, as well as a brake and clutch lining manufacturing setting in the United Kingdom. The authors concluded that the duration of exposure to asbestos dust and the type of work activity performed at the plant correlated with increasing risk of incidence of pulmonary fibrosis (Merewether and Price, 1930). This was basically the first time the term asbestosis was used to describe a unique disease due to exposure to asbestos; rather than simply a pneumoconiosis. Prior to this, it was difficult to know whether breathing difficulties were due to exposure to silica dust, dusts in general, pneumonia, tuberculosis, or other risk factors.

In 1938, Dreessen et al. evaluated the incidence of asbestosis in workers in the asbestos textile industry. Similar to Merewether