D22 Forensic Microscopy and Reverse Engineering in Asbestos-Containing Building Product Identification

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The goal of this presentation is to inform attendees how microscopic analysis of building products can be used to identify the manufacturer of a product.

This presentation will impact the forensic science community by informing attendees regarding how forensic microscopy can be used to identify the manufacturer of a product by reverse engineering a sample (determining its constituents) of the product, then comparing the resulting list of ingredients with product formula information obtained from a number of sources.

In the late 1980s, President Reagan signed into law the Asbestos Hazard Emergency Response Act (AHERA) to address the problem of asbestos in building materials in the nation's schools. To fund asbestos abatement or removal from existing structures, several school systems and state attorney generals sued the manufacturers of asbestos-containing building products. Determination of which specific manufacturer had produced a particular asbestos-containing building product was an important part of this endeavor. The analysis of thousands of individual samples and matching them to their manufacturer (commonly called Product Identification or Product ID) was a large forensic investigation involving thousands of samples from buildings across the United States and Canada.

There were two general objectives of this project. The first was to collect, decipher, and collate information concerning the formula components of asbestos-containing products, and the second was to develop, modify, and apply forensic microscopic methods to identify components in samples of building products.

There were several sources of manufacturers' product formula information. These included court-ordered releases in a number of cases, the 1990 Federal Register publication of the Environmental Protection Agency (EPA) Asbestos Information Act, Mealey's Litigation Reports, and analysis and deformulation of samples from building applications in which the manufacturer claimed ownership. In one of the first cases, a court order from Maryland's attorney general resulted in thousands of pages of formula documents from former asbestos product manufacturers. Although it was a daunting task to organize this massive amount of information so that it could be used efficiently, it soon became apparent that the majority of the products could be classified on the basis of the type of asbestos present and which of about two dozen binders and fillers were used to construct the products.

Forensic microscopy and chemistry methods were developed or modified from classical procedures to identify the product ingredients, which included: perlite, vermiculite, mineral wool, bentonite clay, kaolin clay, Portland cement, precipitated lime, gypsum, sand, limestone, diatoms, talc, starch, cellulose, mica, wollastonite, titanium dioxide, lithapone, sodium silicate, calcium silicate, magnesite, and sodium nitrate. These methods were used to deformulate known samples of product materials.

A comprehensive Excel® spreadsheet database of the asbestos-containing building material product compositions and their manufacturers was constructed. This database was used with forensic microscopy analysis and chemical testing to identify the manufacturer of the majority of asbestos-containing building products. Development of the database could not have been conducted without extensive investigation into brand names and industry-wide or company-specific terms used to identify each of the components listed on a manufacturer's batch production sheets.

For example, an ingredient listed as “Staramic” is a trade name for starch and an ingredient listed as “Snowflake F” is wet-ground limestone (calcium carbonate). This research effort to identify ingredients listed in manufacturers’ documents led to the publication of a dictionary of terms in 1999.[1]

This presentation will provide a detailed description of the processes by which the product formula database was developed and specific examples of the practical application of the forensic microscopy techniques used.

Reference(s):

1. Hopen T.J., J.R. Millette, W.R. Boltin, R.S. Brown. A Dictionary of Terms Related to Additives Found in Asbestos Building Products. *Microscope.* 47(3):163-171. 1999

Building Product, Microscopy, Asbestos