

# Survey of the Biological Effects of Refractory Ceramic Fibres: Overload and Its Possible Consequences

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This paper summarizes the biological effects of refractory ceramic fibres (RCFs). RCFs are aluminosilicate glass insulation wools with similar chemical properties to other synthetic vitreous fibres (SVFs) or 'man-made vitreous fibres' (MMVFs). There is concern that RCFs could be significantly more pathogenic than other SVFs. This paper critically reviews the data on which this perception is based. Morbidity studies on workers in RCF manufacturing indicated that, in the United States, RCF exposure was associated with an increased incidence of pleural plaques and in both the United States and Europe with statistically significant changes in some measures of lung function (though not at present exposure levels). No interstitial fibrosis was found. An ongoing mortality study of limited statistical power has failed to indicate any increased incidence of lung cancer or mesothelioma. Findings in several early animal studies led to a large series of inhalation studies where rats exposed to high levels of RCF developed fibrosis and tumours but not those exposed to other SVFs. Similarly hamsters exposed to one sample (RCF1) developed mesothelioma. Subsequent analyses of the data indicated that the RCF used in these experiments had a significantly greater proportion of non-fibrous particles than those present in the other types of SVFs tested or in workplace air. Short-term studies indicated that pulmonary overload occurred at the same as RCF tissue burdens as those in the long-term animal bioassay. When RCFs were prepared in the same way as the other SVFs, a sample resulted with a more representative ratio of particles to fibres; this sample did not produce overload in short-term tests. SVFs have various abilities to persist in the lung tissue and thus accumulate to varying degrees. It is suggested that biopersistence is a key property. While RCFs are among the more persistent they are similar to many other fibre types. The scientific and regulatory implications of these findings are examined.

**Keywords:** classification; epidemiology; refractory ceramic fibre; risk analysis; toxicology

## INTRODUCTION

The chemical and morphological similarities between their products and asbestos has long encouraged man-made vitreous fibre (MMVF) manufacturers to investigate any possible health effects of exposure to their products. For example, as early as the 1940s the Thermal Insulation Manufacturers Association (TIMA) included 'encouraging environmental and occupational health and safety programs' as one of its aims (Pelnar, 1988).

This paper addresses the possible health effects of occupational exposure to refractory ceramic fibres

(RCFs). These are aluminosilicate glass wools and are defined by the CAS registry number (CASRN) 142844-00-6. RCFs belong to the class of synthetic vitreous fibres (SVFs), which also includes glass, rock and slag wools. The history, chemical and physical properties, production methods, occupational exposure and commercial applications of the RCFs are summarized in several studies (e.g., Maxim *et al.*, 1994, 1997, 2000b). Applications for all of these fibre types are described by the International Agency for Research on Cancer (IARC) in two monographs (1988, 2002) although there are major differences in the taxonomy of fibres between the two reviews.

The desire to identify, control and reduce any risk of occupational illness from the manufacture and use of their products led RCF manufacturers to develop a

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