Superwool™ 607™ HT
Do soluble fibres pose risks?

Fact sheet 6

Key Health Properties

The key health property of Superwool including this latest member of the family, is that any fibres that might be breathed in and reach the lungs are rapidly removed. This characteristic is referred to as low bio-persistent. The shorter the time a fibre remains in the body the less chance it can exert any effect and, by disappearing before being joined by other fibres, any accumulation is minimised.

Low bio-persistentcy is achieved by producing the fibres out of a glassy material, which partially dissolves and then fragments when it comes into contact with the fluids found in the lungs.

However, does this ensure that these fibres are really as safe as they can be? Can we be sure that the fibre fragments and dissolved materials do not pose any danger?

Superwool fibres are made only using chemical elements that are themselves generally regarded as safe. Non-fibrous materials with the same chemical composition as Superwool are permitted ingredients in foods, medicines and cosmetics as well as having many uses in industry. In none of these applications has this group of compounds been found to be dangerous. Even fibrous calcium silicate is not regarded as carcinogenic by the World Health Organisation and is exonerated under the extremely rigorous German regulations and in the whole EU.

We are all exposed to considerable amounts of dust from environmental as well as industrial sources. A lot of this dust resembles Superwool in that, among other components, it contains a great deal of silicates and calcium. If fine enough to reach the lungs, this dust is removed by cells known as macrophages - the “dust carts” of the body - these cells with their dust content are swept up the airways, swallowed and the dust voided via the gut. Superwool fibres, which are initially too long to be carried away by the macrophages, are partially dissolved and break into short pieces, which are then cleared in a similar manner to dust particles. Chalk and cement are good examples of dusts, which contain the same elements as Superwool. These also partially dissolve and their components enter the normal body contents of these elements. These calcareous dusts do not cause disease, unless they are contaminated by other materials.

Of course the body also needs a regular input, usually from food, of all the major elements making up Superwool. A simple calculation (details in appendix), taking into account Superwool workplace levels of fibrous dusts, the amount of air breathed and fibre deposition in the lungs, shows that fibre concentrations in the air would have to be hundreds of times greater than they are to provide inputs which even approach those in food.

It is true that the concentrations and distribution of these elements in the blood, tissue and other “compartments”, is very carefully controlled by a number of more or less complicated mechanisms. Maintaining this control is essential for good health.

Could inhaled Superwools affect these control mechanisms?

This is unlikely as the body can easily handle dusts with similar components. The dissolved elements coming from such dusts are the same as those, which dissolve out of Superwool, and no effect of even large exposure to these materials has been detected.

Conclusion

Although AES fibres, such as Superwool, are designed to dissolve and fragment after being inhaled, the chemical elements released into the body are the same as those commonly found in nuisance dusts or in food. The quantity released is very small in comparison to these other sources and so the body's normal systems of regulation are easily able to cope. These considerations have been central in the development of Superwool 607 HT.

Prof. R.C.Brown
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Superwool® 607 HT®

Appendix

Dosimetric considerations

Workplace exposures to all the man made fibres have been measured in many industries and locations. For the general public, exposures are usually undetectable. The vast majority of occupational exposures to fibres meeting the WHO criteria are below 1 F/ml.

To examine any risk from the components of dissolved fibres the following assumptions (which may be easily modified) may be made:-

- Exposure is to 1F/ml for eight hours a day 250days a year
- Each fibre has an average volume of about 20µm^3
- The specific density of the fibres is about 2.6
- Each worker inhales 10m^3 air per day
- There is 100% deposition of the inhaled fibres
- Over the year the entire inhaled fibre population dissolves

These assumptions mean that during a shift each worker could inhale approximately 400µg of fibre or approximately 100mg per year. To give a maximal daily uptake averaged over the whole year equivalent to 0.3 mg fibre, this can be compared to exposure to the components of Superwool from other sources.

Element	Typical Daily intake from Food (mg)	Maximum intake from fibre inhalation (mg)	Maximum fibre intake as proportion of a dietary intake (as %)	Approx exposure (in F/ml) needed to equal dietary intake
Calcium	1000	0.1	0.01	10,000
Silica	50	0.15	0.3	300
Magnesium	400	0.1	0.025	4,000

Comments

- Persons will be exposed by routes other than in their food so that their intake of these elements from fibres will account for a smaller proportion of their total uptakes than calculated here.
- 100% deposition of inhaled fibres is assumed. The actual value is more likely to be near 10%.
- The fibres will not completely hydrolyse and release all their components. In practice rapidly clearing fibre fragment. The fragments will then be cleared by macrophages to the gut.

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