

Deleterious Materials of the Future

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Introduction

Definitions and historical perspectives



- A deleterious material is one that performs in an undesirable or unexpected way
- History is littered with examples – asbestos, lead, HAC, calcium chloride etc
- But virtually all materials have the capability to be harmful or deleterious if used incorrectly



- “Modern materials are more of a threat than a promise to the green agenda. Many of them poison the people who manufacture them and pollute the earth both in their creation and disposal” Lidell,H
- “We often see very polarised views on materials, but this debate should be more complex. We need to consider the benefits and burdens of every material we use”.
Campbell,A

- All the business of war, and indeed all the business of life is to endeavour to find out what you don't know by what you do; that's what I called "guessing what was on the other side of the hill"



Some thoughts – with help from Heraclitus

- Don't take information at face value
- Expect the unexpected*
- Don't overlook the obvious
- Understand the risks

*If you do not expect the unexpected you will not find it, for it is not to be reached by search or trail.



Don't take information at face value

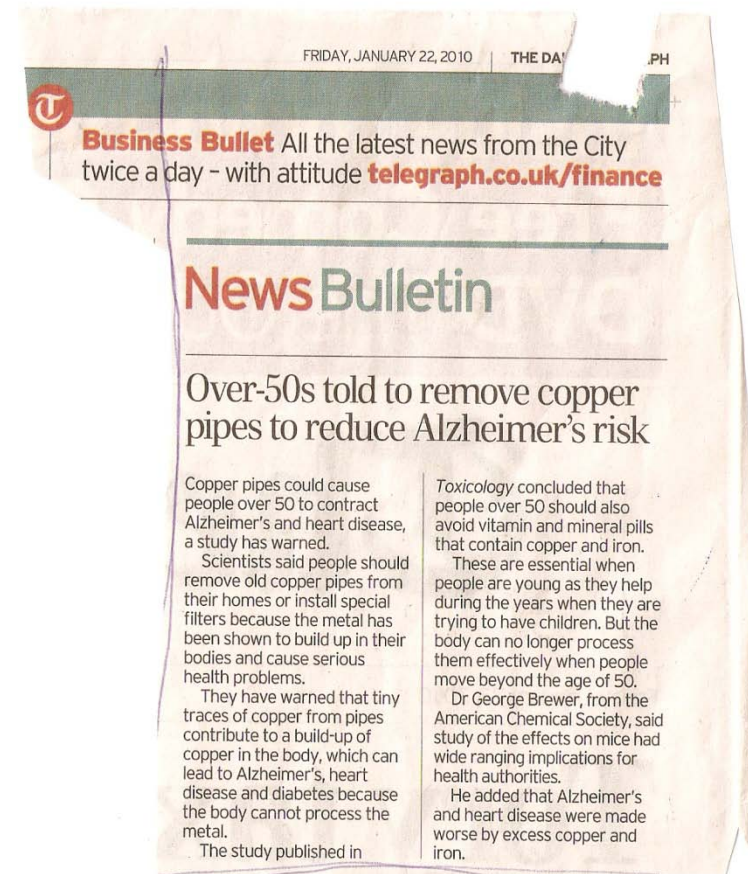
Copper pipes and pvc



- Iron and copper are necessary for a number of biological functions in the body
- These metals are essential for reproductive functions but the oxidant damage from copper and iron excess stores of metals builds up as we age



An association between disease and exposure to copper and iron and in particular how copper and iron might be associated with cognition problems, arteriosclerosis, diabetes, Alzheimer's and Parkinson's disease.



- Study found that people with higher intakes of copper and a high-fat diet had “lost cognition” more rapidly than expected
- However the study was a “narrative review”
- May not present all the information – author could select material that supports his thesis
- One author – may not have been peer reviewed

- “one of the most environmentally hazardous consumer materials ever produced”

Thornton J.



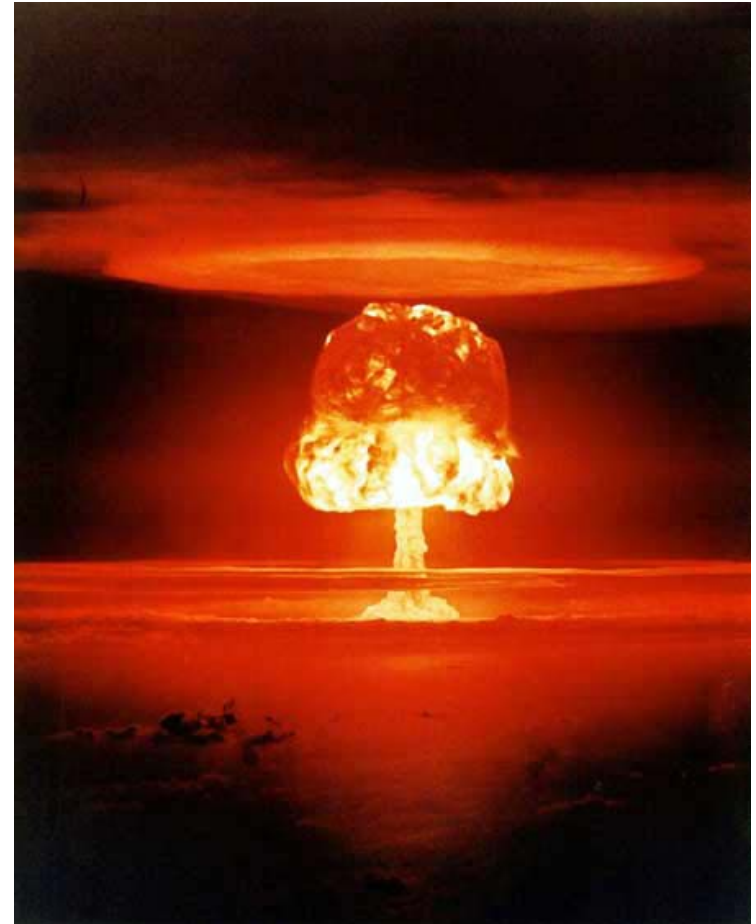
- Detractors say it is chlorine based
- Contains stabilisers (lead cadmium)
- Contains plasticisers -phthalates – now established as a global pollutant
- Producers say it is based on salt
- Increasing moves to recycle
- Metal content being reduced
- But recycled content may still contain plasticisers

Expect the unexpected

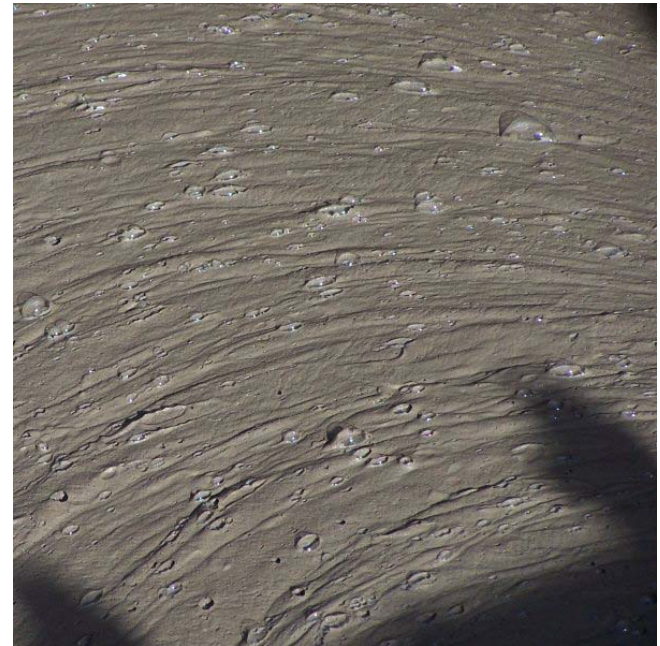
Exploding concrete



- Foamed concrete produced using Incinerator Bottom Ash (IBA)
- Material that falls into a quenching pool in municipal incinerators
- Often contains lead, zinc and other heavy metals in dangerously high concentrations. Much of this waste is currently allowed to be used for aggregate or use in construction materials



- Foam concrete is a cement-bonded material made by blending an extremely fluid cement paste (slurry), into which is injected a stable, pre-formed foam, manufactured on site. Some, but not all foamed concrete mixes can contain IBA.
- Typical uses include void filling, highways applications.



- Aluminium particles in IBA react with the alkaline cement paste to produce hydrogen gas
- If gas cannot escape, it can build up to critical levels
- Currently awaiting HSE investigation following explosion incidents – prohibited by The Highways Agency



Don't overlook the obvious
Compact Fluorescent Lamps



- Used to produce UV light in compact fluorescent lamps
- Can produce birth defects, brain damage, weakening of immune systems
- Symptoms typically include sensory impairment (vision, hearing, speech), disturbed sensation and a lack of coordination.
- “Mad Hatter’s Disease”



- Typical CFL lamps contain 5mg mercury – 80% more efficient than incandescent bulbs
- Enough to pollute 30,000 gallons of water
- Risk of aggravation of certain disease related symptoms by UV/blue light radiation in some patients with diseases such as chronic actinic dermatitis and solar urticaria
- Exposure to mercury through broken bulbs, landfill etc



HPA Guidance for dealing with CFL lamps

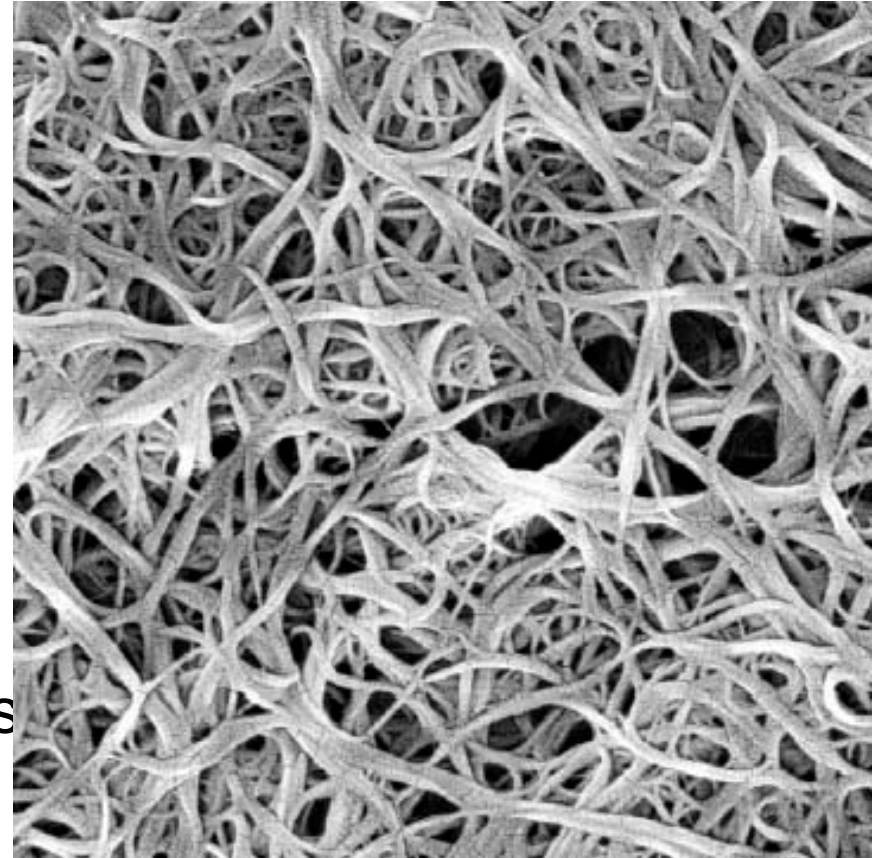
- Take care to prevent injury from broken glass.
- Vacate the room and keep children and pets out of the affected area. Shut off central air conditioning system, if you have one.
- Ventilate the room by opening the windows for at least 15 minutes before clean up.
- Do not use a vacuum cleaner, but clean up using rubber gloves and aim to avoid creating and inhaling airborne dust as much as possible.
- On hard surfaces sweep up all particles and glass fragments with stiff cardboard and place everything, including the cardboard, in a plastic bag. Wipe the area with a damp cloth and then add that to the bag. Household cleaning products should be avoided during clean up despite the very small amount of mercury involved. See the next section for cleaning carpeted surfaces.
- Use sticky tape to pick up small residual CFL pieces or powder from soft furnishings and then add that to the bag.
- The plastic bag should be reasonably sturdy and needs to be sealed, but it does not need to be air tight. The sealed plastic bag should be double-bagged to minimise cuts from broken glass.

Understand the risks

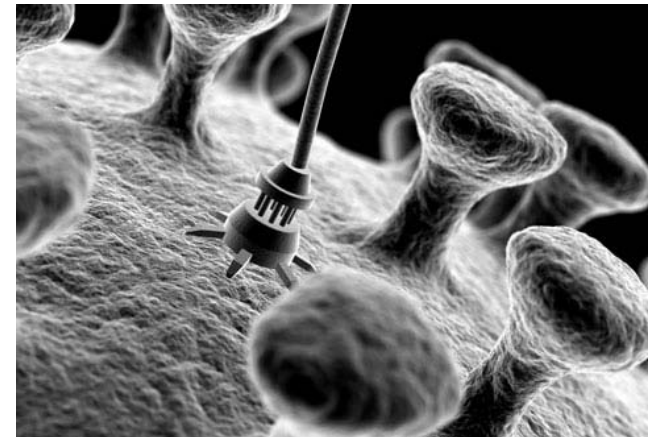
Nanoscience , fibres and formaldehyde



- In 2006 <£14m on nano building materials
- By 2016 £27m
- and by 2025 £5bn
- Titanium dioxide and carbon nanotubes
- Coatings for cleaning, protection, waterproofing,insulating
- Solar and lighting technology
- In 10 years or so, components and adhesives
- Source: Nanotechnology for Green Building Elvin,G

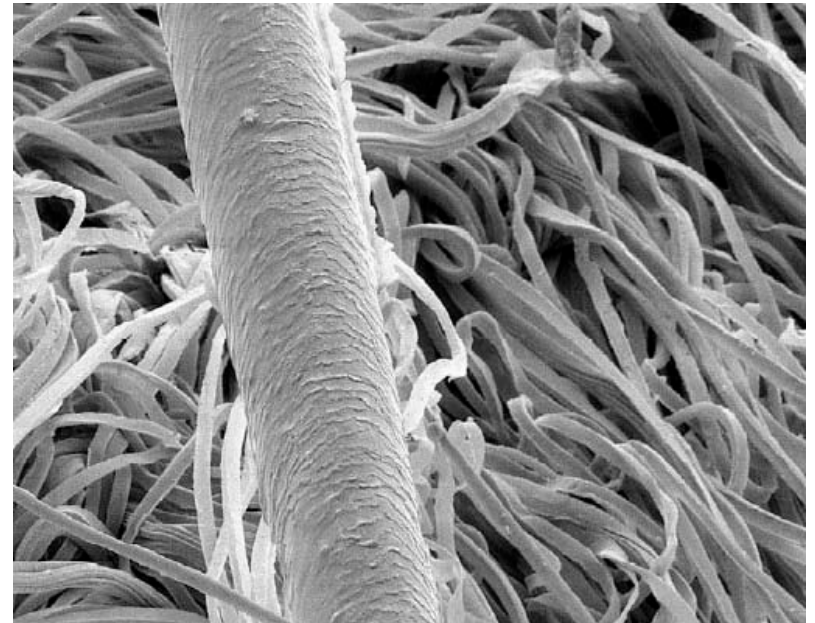


- The European Agency for Safety and Health at Work has published a series of forecasts providing an overview of the potential emerging risks in the world of work
- Among the top ten emerging risks, three have in common their physico-chemical state as insoluble particles or fibres: nanoparticles and ultrafine particles, diesel exhaust, and man-made mineral fibres.
- The experts agreed that nanoparticles and ultrafine particles pose the strongest emerging risk.

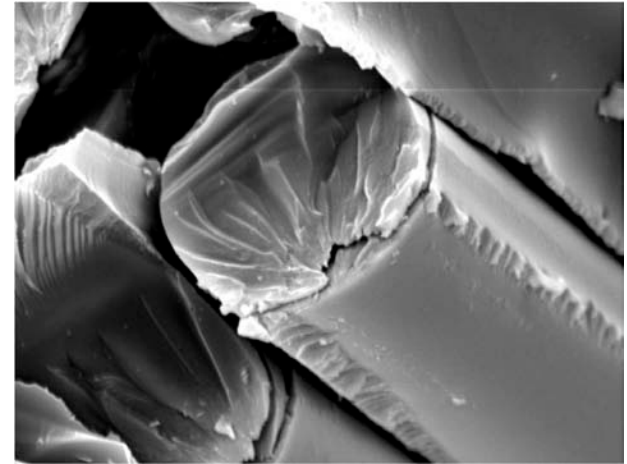


- One nanometre (nm) is equal to one-billionth of a metre
- A human hair is 80,000 nm wide on average
- A red blood cell is approximately 7,000 nm wide
- Can enter the body by ingestion; inhalation or by the skin
- Once in the body, nanoparticles can move to other organs or tissues of the body

- Properties that may be important in understanding the toxic effects of nanomaterials include particle size and size distribution, agglomeration state, shape, crystal structure, chemical composition, surface area, surface chemistry, surface charge, and porosity



- One of the top 10 emerging risks – European Agency for Safety and Health at Work
- Fibres with a geometric diameter less than 3 microns may reach the alveolar zone of the lungs.
- Fibre size is linked to their harmful toxic effects (the longer and thinner the fibres, the more dangerous they are).
- standard air sampling methods do not allow precise measurement of fibre size.
- Specific fibre dimensions hypothesised to have a biological activity have been proposed but need to be evaluated in epidemiologic studies.



- continuous filament (glass wool)
- insulation fibre – stone wool (rock wool or slagwool)
- ceramic fibre (or refractory fibre) (RCF and
- special purpose fibre
- Fibres below about 5 microns in diameter are considered to be respirable



- There is insufficient data to establish a relationship between the inhalation or ingestion of MMF and cancers, but laboratory studies in animals have produced carcinogenic symptoms in some cases
- Mineral wools are classified as Category 3 carcinogens
- Derogations for classification are allowed if certain criteria are met. In practice, none of the commercial mineral wools currently on the market require classification as Category 3 carcinogens

- Use of formaldehyde resins – a known carcinogen
- Off gassing
- Inhalation of particles during machining
- Carpenters at risk of nasal cancers – but not specifically due to mdf



Conclusions

Recap



- Don't take information at face value
- Expect the unexpected
- Don't overlook the obvious
- It is increasingly difficult to weed through the plethora of conflicting information, studies and opinion. Many articles are persuasive, but make sure that they give a balanced view.

“Common sense is not so common.”
-Voltaire

