

NANOSILVER

KEY POINTS

- Silver nanoparticles are one of the fastest growing product categories using nanotechnology. The greatest growth is in consumer products, some of which are available in Australia.
- Nanotechnology allows silver to be incorporated into fabrics, plastics and onto surfaces for self-cleaning applications.
- Following exposure to relatively high oral or dermal doses, humans can develop skin discoloration. However, the main concern with nanosilver is the environmental risk, particularly if significant amounts are dispersed into the environment.
- The Australian Government is aware of, and in some cases are supporting, further research and analysis to provide a robust evidence base from which to make further decisions on the use and management of nanomaterials, such as nanosilver.
- The Australian Government's activities include a program of work to examine the potential environmental, health and safety impacts of nanotechnology. This work includes:
 - Commissioning a review of the literature on the environmental fate of nanoparticles including nanosilver. (*Dept of the Environment, Water, Heritage and the Arts*)
 - Commissioning research to determine the partitioning of both metallic and carbon-based nanoparticulates, including nanosilver in a representative number of Australian soils and in soils exposed to urban waste streams. (*Dept of the Environment, Water, Heritage and the Arts*)
 - Participating in the OECD program to test the human health and environmental safety effects of a number of nanomaterials. Australia has a particular interest in nanosilver. (*NICNAS & CSIRO*)

Relevant to previous Estimates questions

- Colloidal silver was apparently sprayed on surfaces of the Hong Kong underground transport system as a public health measure. A colloid may or may not be a nanoparticle with its size ranging from 1nm to 1,000nm.
- Government officials are unaware of any nanosilver in use on any public transport systems in Australia at this time.
- Questions about whitegoods (and other consumer products not regulated by APVMA, FSANZ, and TGA) should be directed to the ACCC, who look after product safety, and NICNAS, who assist with technical advice on specific industrial chemicals.

BACKGROUND

Silver is known to be effective in killing a wide range of bacteria. This behaviour is attributed to the silver ions (positively charged silver atoms).

Nanosilver is used in a range of products such as coatings on medical devices to reduce infection rates, coatings on artificial joints and pacemakers to prevent deadly microbial growths, and coating of ceramic filters for water purification. However, most products that use nanosilver are household items where the nanosilver provides an antibacterial function to keep surfaces clean or to reduce odours (see **Attachment A** for a list of some products available in Australia). The Project on Emerging Nanotechnologies in the USA has a database of 240 products using nanosilver identified in September 2007.

Will the silver ions released from nanosilver cause human health or environmental health impacts?

If enough silver is consumed, the silver can be deposited under the skin and turn it to a blue-gray colour (called 'argyria'), and this is considered the main toxicity associated with silver.

On the other hand, nanosilver is being engineered to release silver ions, which are toxic to bacteria. Some products, such as washing machines that feature silver as a cleaning agent, are designed to release silver into the wash and hence the environment; other products, such as self-deodorising socks, contain nanosilver impregnated into the fabric. In this case, the nanosilver is not designed to leach out, but some studies have shown that nanosilver can indeed be washed out of these articles.

There is an increased risk of environmental impacts from nanosilver if substantial releases of the nanomaterial occur as the use of products containing nanosilver becomes more widespread. Internationally, levels of conventional silver emissions have peaked in the past, and the characteristic was for a halo of silver contamination to surround domestic waste treatment plants. This is not a current problem, but total silver emissions will need to be monitored as the nanosilver applications grow.

Can we identify and manage any new risks from nanosilver?

Nanosilver poses questions common across nanomaterials. How does size, shape, charge state, etc alter its toxicity. Combined with unknown levels of exposure, this equates to an uncertain risk. The Australian Government is working closely with national and international partners to ensure that the regulatory requirements are sufficiently robust to manage any risks posed by nanomaterials.

Some examples of Government action addressing and assessing risks from nanosilver

Australia is participating in the OECD program plans to test nanomaterials for their physical-chemical properties; environmental degradation and accumulation;

environmental toxicology; and mammalian toxicology. Australia has agreed to participate in testing nanosilver as part of this program.

Following up from the report on environmental fate of nanoparticles, the Department of the Environment, Heritage and the Arts have now commissioned a research study to determine the partitioning of both metallic and carbon-based nanoparticulates, namely nanosilver, cerium oxide, fullerene and carbon nanotubes in a representative number of Australian soils and in soils exposed to urban waste streams.

Australian exposure to nanosilver

The Office of the Australian Safety and Compensation Council (OASCC), within the Department of Education, Employment, and Workplace Relations, conducted a review of organisations using nanomaterials from data available in the public domain. They identified eight universities working with nanosilver and five companies.

The National Industrial Chemical Assessment and Notification Scheme (NICNAS) located within the Department of Health and Ageing, conducted a voluntary call for information on the use of nanoparticles in the commercial sector during 2005-06. No usage of nanosilver was recorded.

Agencies are conducting further workplace and company surveys currently to update data in this area.

Excerpts from Senate Estimates February 2008

Senator MILNE—Can anyone tell me whether nanosilver is being used in any of the public transport systems in Australia at this time?

Dr Besley—I cannot.

Mr Pennifold—I cannot comment. I do not know.

Senator MILNE—Since China is manufacturing a lot of whitegoods that come into Australia, can you tell me whether there are any fridges coming into Australia that use nanoparticles of silver coating on their inner surface, and as well similarly so for cutlery, chopping boards et cetera?

Mr Pennifold—I am not able to answer that.

Senator MILNE—Would that come under the Therapeutic Goods Administration or under FSANZ? If I went to buy a fridge, how would I know whether it has nanoparticles in it, given that nanosilver kills all bacteria, good and bad? That is why it is being used in public transport systems and that is why people are terrified of it. I am concerned that this is getting away from us and consumers do not know. Who can tell me, as to the regulatory framework in Australia, whether any whitegoods coming into the country are lined with nanosilver particles?

Mr Pennifold—That would be a question that you would need to put to the regulators.

Senator MILNE—Which one?

Mr Pennifold—It is probably best to direct it to the Health portfolio.

Extract from Friends of the Earth submission to Minister Carr: July 2008

Product type	Nanomaterial	Manufacturer	Brand names/products	Purpose	Source
Clothing	Silver	Healthy Channels	Antibacterial socks	Antibacterial/ odour repellent	http://www.australian-uggs.com/complimentary-site-links-footwear.htm
Clothing	Silver	Australian Wool Innovation Ltd	"Nanotech AB" anti-bacterial woollen garments	Antibacterial/ odour repellent	http://www.wool.com.au/attachments/Publications/Corporate/AWI_annualreport06_product_mar_dev.pdf
Dishwashing cloth and kitchen wipe	Silver	Merino Pty Ltd	"Antibacterial wipes with natural silver"	Antibacterial	http://www.ultra-fresh.com/tra/includes/DocumentViewing.cfm?ID=401
Household appliances	Silver	Samsung	Samsung appliances, including refrigerator, air conditioner, washing machine, vacuum cleaner	Antibacterial	http://www.samsung.com/ph/silvernano/
Refrigerator	Silver	LG Electronics	Model: GR-R579JQA Top-mount refrigerator	Antibacterial	http://au.lge.com/products/model/detail/home_appliance_refrigerator_topmount_grr579jqa.jhtml
Rubbish bin	Silver	LG Electronics	BioTank Nano-Silver Hygienic Dust Bin	Antibacterial	http://www.lge.com/products/model/detail/v-kc402ctu.jhtml