Submission No 20

INQUIRY INTO NANOTECHNOLOGY IN NEW SOUTH WALES

Organisation: Victorian Trades Hall Council

Name: Ms Renata Musolino

Position: Occupational Health and Safety Information and Website Officer

Telephone: 03 9659 3571

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Victorian Trades Hall Council

Submission to the Standing Committee on State Development Inquiry into Nanotechnology in NSW

For further information, contact:

Renata Musolino
VTHC OHS Information and Website Officer
VTHC OHS Unit
54 Victoria St,
Carlton South, 3053 Victoria
Ph: 03 9659 3571

Introduction

It is very likely that "nanotechnology" will impact all industries and sectors of the Australian economy. Any action (or non-action) taken in NSW will also potentially impact what other Australian jurisdictions may or may not do. For this reason, the VTHC has made this submission to the NSW Inquiry.

While there is no doubt about the potential benefits of nanotechnology, there is a great deal of uncertainty regarding the potential dangers of it to workers, the general community and the environment. There is little doubt that nanotechnology introduces potentially serious new risks to both human health and the environment.

The UK's Royal Society and Royal Academy of Engineering have recommended that given the emerging evidence of serious nanotoxicity risks, nanomaterials should be treated as new chemicals[i] and be subject to new safety assessments prior to their inclusion in consumer products[ii]. They further recommended that factories and research laboratories should treat nanomaterials as if they were hazardous[iii], and until the environmental impacts of nanomaterials are better known, their release into the environment should be avoided as far as possible[iv].

At this point, not a single national government has yet introduced regulations that require nanomaterials to be subject to new safety assessments either during manufacture or prior to release. In fact there is no requirement for importers or manufacturers to even notify government or workers who are potentially exposed that they are importing, using or manufacturing nanomaterials.

Our current legislative framework is inadequate when it comes to materials in nano form. The failure of government regulators to take seriously the early warning signs surrounding nanotoxicity[v] suggests that they have learnt nothing from any of the long list of disasters that resulted from the failure to respond to early warning signs about previous perceived 'wonder' materials (like asbestos, DDT and PCBs)[vi]. The VTHC position is that in accordance with recommendations from the Royal Society, manufactured nanoparticles be treated as new chemicals, subject to new safety assessments, and clear labelling, before being permitted in commercial use.

The ACTU, to which the VTHC is affiliated, is a signatory to the *Principles for Nanotechnologies and Nanomaterials Oversight*[vii].

The call for precautionary management of nanotoxicity risks

In 2004 the United Kingdom's Royal Society – the world's oldest scientific institution – in conjunction with the Royal Academy of Engineering made very explicit recommendations for the precautionary management of nanotoxicity risks[viii]:

- "We recommend that chemicals in the form of nanoparticles or nanotubes be treated as new substances …in the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)… (Section 8.3.2: paragraphs 18 & 19)"
- "We recommend that ingredients in the form of nanoparticles undergo a full safety assessment by the relevant scientific advisory body before they are permitted for use in products… (Section 8.3.3: paragraph 24 & 23)"

- "We recommend that the ingredients lists of consumer products should identify the fact that manufactured nanoparticulate material has been added (Section 8.3.3: paragraph 26)"
- "Until more is known about environmental impacts of nanoparticles and nanotubes, we recommend that the release of manufactured nanoparticles and nanotubes into the environment be avoided as far as possible (Section 5.7: paragraph 63)"
- "Specifically, in relation to two main sources of current and potential releases of free nanoparticles and nanotubes to the environment, we recommend:
  (i) that factories and research laboratories treat manufactured nanoparticles and nanotubes as if they were hazardous, and seek to reduce or remove them from waste streams. (Section 5.4: paragraph 41)
  (ii) that the use of free (that is, not fixed in a matrix) manufactured nanoparticles in environmental applications such as remediation be prohibited until appropriate research has been undertaken and it can be demonstrated that the potential benefits outweigh the potential risks. (Section 5.4: paragraph 44)"

Almost four years later, there are still no nanotechnology-specific laws at a national level anywhere in the world – despite the alarming increase in world-wide activity in the field and increasing numbers of products now commercially available.

The Head of the Science Strategy and Statistics Division of the UK Health and Safety Executive has recommended that rigorous regulation be developed to prevent nanoparticle exposure becoming the 'new asbestos'. He noted that if regulators introduce "controls that are too lax, significant health effects [will] harm many people. The history of asbestos should warn all of society of the human and financial costs of this possibility"[ix]. This comparison is one that is readily understood by thousands of workers and as unions we do not want to see a potentially even greater tragedy – we do not want to, once again, legislate only after the bodies begin to be counted.

Even insurance companies are concerned. To safeguard against a repeat of the asbestos experience, the world's second largest re-insurer, Swiss Re, has believes that conservative regulation that puts health and safety first must be adopted to manage nanotechnology's risks, irrespective of uncertainties in scientific circles: "In view of the dangers to society that could arise out of the establishment of nanotechnology, and given the uncertainty prevailing in scientific circles, the precautionary principle should be applied whatever the difficulties"[x].

Yet despite the clear need for action to protect workers, the public and the environment from nanotoxicity's risks, existing regulations in Australia and internationally still fail to differentiate between larger particles and nanoparticles. There are still no nanotechnology-specific national level regulations anywhere in the world.

Another concern is that research into nanotechnology's risks and challenges is grossly under-funded. Important research into nanotechnology's health and environment risks receives less than 0.85% (US$11 million) of the United States NNI budget[xi] and only 5% of the European Sixth Framework Programme budget (2002-2006)[xii]. World-wide, a tiny 0.4% of nanotechnology research spending is on research into risks for human health and the environment[xiii]. Although the amount of funding dedicated to nanotoxicology research in Australia has increased recently, it is still insufficient to enable researchers to investigate the safety of many of the nanomaterials now in commercial use.

Probable harm to human health

More and more evidence is emerging that nanomaterials used in commercially available consumer and industrial products present very serious new toxicity risks to human health. Yet we have no idea of the potentially countless numbers of workers and the public who are being exposed to manufactured nanomaterials daily while there is little data on potential long-term or chronic effects of these materials[xiv].

There is a general relationship between toxicity and particle size. The smaller a particle, the greater its surface area compared to its volume, the higher its chemical reactivity and biological activity, and the more likely it is to prove toxic[xv]. There is often no relationship between the toxicity of a nanoparticle and the toxicity of a larger particle of the same substance[xvi]. This key principle is yet to be reflected in the regulatory system.

Nanomaterials are much more readily taken up by the human body than larger sized particles. Nanomaterials can enter the blood stream following inhalation[xvii] or ingestion[xviii]. At least some nanomaterials can penetrate the skin[xix], especially if skin is flexed[xx] or exposed to surfactants[xxi] as is likely in many workplaces. Broken skin is an ineffective particle barrier[xxii], permitting uptake of particles 7,000nm in size.

Once in the blood stream, nanomaterials can be transported around the body and are taken up by organs and tissues including the brain, heart, liver, kidneys, spleen, bone marrow and nervous system[xxiii]. Nanoparticles are able to cross membranes and gain access to cells, tissues and organs that larger sized particles normally cannot[xxiv]. Unlike larger particles, nanomaterials may be taken up by cell mitochondria[xxv] and the cell nucleus[xxvi]. Nanomaterials have proved toxic to human tissue and cell cultures, resulting in increased oxidative stress, inflammatory cytokine production and cell death[xxvii]. Test tube studies have shown that nanomaterials can cause DNA mutation[xxviii] and induce major structural damage to mitochondria, even resulting in cell death[xxix]. We know very little about how long nanoparticles may remain in the body and what sort of ‘dose’ produces a toxic effect.

While size is a key factor in determining the potential toxicity of a particle, it is not the only important factor. Other properties of nanomaterials that influence toxicity include: chemical composition, shape, surface structure, surface charge, aggregation and solubility[xxx], and the presence or absence of ‘functional groups’ of other chemicals[xxxi]. The large number of variables influencing toxicity means that it is difficult to generalise about health risks associated with exposure to nanomaterials – each new nanomaterial must be assessed individually and all material properties must be taken into account.

Workers who handle, manufacture, package or transport products that contain manufactured nanomaterials are likely to face higher levels of exposure than the public and on a more routine basis. This is of great concern because scientists still do not know what levels of nanomaterial exposure may harm workers’ health, and whether or not any level of occupational exposure to nanomaterials may be safe. Furthermore, reliable systems and equipment to prevent occupational exposure do not yet exist, and we have yet to identify a general basis for measuring and characterising nanomaterial exposure that does occur[xxxii].

So while there have been recommendations regarding good occupational health and safety practices to limit the exposure of workers to nanomaterials, because there is mandated duty to even inform workers that they may be being exposed, we are concerned that they are being unknowingly exposed.

In March 2007, the International Union of Food, Agricultural, Hotel, Restaurant, Catering, Tobacco and Allied Workers' Associations (IUF) called for a global moratorium on nanotechnology. The IUF represents nearly 12 million workers from over 120 countries. The IUF cited concerns regarding occupational exposure to nanomaterials, the health and environmental risks of nanotoxicity, the broader socio-economic implications of nanotechnology, and the failure to involve the public in decision making about the introduction of this powerful new technology.

The appropriateness of the current regulatory frameworks in operation for the management of nanomaterials over their life-cycle

In order to minimise harm to workers, the broader community and the environment, Australia must have a comprehensive and integrated nanotechnology-specific governance framework, and this should be developed with genuine participation of all stakeholders – unions, public health and environmental groups. A piecemeal approach to nanotechnology regulation will leave people and the environment exposed to serious risks and will fail to manage nanotechnology's social challenges, setting the nanotechnology industry up for a repeat of mistakes experienced with other 'emerging' technologies.

In its 2006 report, the European Union's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) recognised the many systemic failures of existing regulatory systems to manage the risks associated with nanotoxicity[xxxiii]. Despite its clear public interest value, the review conducted by Monash University academics of Australia's regulatory systems and their adequacy to manage the risks associated with nanotechnology has not been released publicly[xxxiv]. However academic reviews of regulatory measures in Australia, as well as England, the United States and Japan found that none of these countries require manufacturers to conduct nanotechnology-specific safety assessments of products that contain manufactured nanomaterials before they are released on to the market[xxxv].

Existing regulatory systems treat all particles the same; that is, they do not recognise that nanoparticles of familiar substances probably have novel properties and novel risks[xxxvi]. We know that many nanoparticles now in commercial use often pose greater toxicity risks than the same materials in larger particle form. However if a substance has been approved for use in larger particle form, it is also legal to use it in nanoparticle form. There is no requirement for new safety testing, labelling to inform workers and consumers, new occupational exposure standards or measures to protect workers or to ensure environmental safety. Incredibly, there is not even a requirement that the manufacturer notify the relevant regulator, that they are using nanomaterials in the manufacture of their products.

Why existing laws are inadequate to assess the risks posed by nanomaterials in commercial use

- Toxicity risks of nanomaterials remain very poorly understood
- Nanomaterials are not assessed as new chemicals
- Current methods for measuring exposure are not suitable for nanoparticles
- Current safety testing is not suitable for nano
- Many safety assessments use confidential industry studies

The National Nanotechnology Strategy- adequacy in the NSW context

We are indebted to the Friends of the Earth for undertaking an analysis of the National Nanotechnology Strategy. Key deficiencies identified by FoE include:

- No proposal for a new regulatory regime capable of managing nanotechnology's many risks and challenges
- Rejection of the precautionary principle
- No recommendation for meaningful public participation in the development of the National Nanotechnology Strategy
- No discussion of the impacts of technological convergence, which most commentators believe is critical to nanotechnology's transformative potential
- No immediate action to protect workers, the public and the environment from the risks of nanotoxicity
- No discussion of the application of nanotechnology to food and agriculture
- No support for mandatory product labelling to enable workers to know they are dealing with nanomaterials and consumers to make an informed choice
- No serious treatment of ethical concerns associated with nanobiotechnology, human enhancement, military applications or nano-surveillance
- No strategy to manage risks of nanobiotechnology, including to safeguard against nanobioweaponry or nanobioterrorism
- No economic analysis, or discussion of nanotechnology's potential impacts on labour markets, commodity trade, or capacity to result in large-scale economic upheaval
- Consistent failure to put public interests ahead of business interests

All of these deficiencies will have implications in the NSW, and more generally the Australian context. There is an urgent need for review of the National Nanotechnology Strategy. NSW could play a useful role, along with the other states, in assisting the federal government to develop a more adequate National Nanotechnology Strategy.

Recommendations

The Victorian Trades Hall Council calls on the NSW Standing Committee on State Development to support a moratorium on the commercial use of nanotechnology until the following are achieved:

- public consultation to inform decision-making regarding nanotechnology, research funding, and governance issues
- All relevant stakeholders are given the opportunity to contribute to a review of Australia's management of nanotechnology, including efforts to address its risks and challenges
- Precaution-based, comprehensive legislation is introduced to protect the public, workers and the environment from nanotechnology's risks and to manage its social challenges
- All nanomaterials are classified as new chemicals (as per recommendations from the United Kingdom's Royal Society) and subject to rigorous new safety assessment prior to commercial use
- Proactive research and monitoring regime is established
- Mandatory labelling of any approved nanomaterial and nanotechnology-based ingredients or components of commercial products

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