

# Friends of the Earth (Australia)

## Nanotechnology Policy Statement

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### Introduction

Nanotechnology is a powerful new technology for taking apart and reconstructing nature at the atomic and molecular level. It is being touted as the basis of the next industrial revolution and will be used to transform and construct a wide range of new materials, devices, living organisms and technological systems.

Observers suggest that nanotechnology has the potential to fundamentally transform every aspect of our lives. Nanotechnology will underpin and impact upon all industries and sectors of the economy, facilitating far-reaching changes in social, economic, military and ecological relations. Such far-reaching reaches will inevitably result in large-scale social disruption. Nanotechnology is also likely to exacerbate existing global economic inequities, further entrenching a North/ South divide. The products of nanotechnology also pose serious new threats to the health of humans and the environment.

Yet nanotechnology is being developed and commercialised in a regulatory vacuum, and largely outside of general public awareness, debate, or participation. The products of nanotechnology research — such as nanoparticles and other nanomaterials — are already being manufactured and released into the environment without being subjected to adequate — if any — health and safety testing or environmental impact assessment.

### Definition of Nanotechnology

Nanotechnology is commonly defined as manufactured materials, structures and systems that exist and operate at a scale of 100 nanometres or less. (One nanometre is

one billionth of a metre — a human hair is 80,000 nanometres in width, a red blood cell 7,000 nm wide.) Nanotechnology can also be defined as the range of new techniques enabling the direct manipulation and reconstruction of the world at the atomic or molecular level.

A number of forms of nanotechniques can be distinguished, including:

- nanoparticle production: this includes carbon nanotubes, buckyballs, quantum dots, and the nano-scale manufacture of previously larger scale materials and chemical compounds (such as metal oxides);
- nanofabrication and molecular manufacturing: these include a range of existing and hypothetical techniques and processes for assembling supra-molecular constructions and larger products from the bottom up;
- nano-biotechnology: this includes the use of nanotechnology to manipulate living organisms and to enable the merging of biological and non-biological materials.

Manufactured nanomaterials are deliberately engineered and can be distinguished from nanoparticles that ‘exist in nature’, or are by-products of other human activities. In the past, nano-sized particles have been produced incidentally as a by-product of forest fires and high-temperature industrial processes including combustion, welding and grinding.

It is the manufactured or engineered nanotechnological products and processes that are the primary focus of the issues raised in this policy. However many of the safety and regulatory issues relating to manufactured nanomaterials are also relevant to incidentally produced nanoparticles (e.g. the need to establish safe workplace exposure limits for all types of nanoparticles).

## **General Issues of Concern**

### ***Human Health and Safety Issues***

The production and release of nanomaterials — such as manufactured nanoparticles and nano-biotechnological products — pose serious new threats to human health and safety. Despite the billions of dollars invested in nanotechnology’s commercial applications, very little research has been directed towards analysis of health or environmental impacts. However there is a range of health and safety concerns.

The reactivity, mobility and toxicity of nano-scale particles are greater than larger sized particles of the same substance. At the nano-scale, even normally harmless substances may become hazardous, with increased toxicity to humans and other living organisms. This renders toxicity tests of larger particles of a substance irrelevant to determining the safety of nano-sized relatives.

Workers and researchers involved in the manufacture and use of nanoparticles currently face the greatest level of exposure and are most directly threatened by nanoparticle toxicity. Indeed, insurance companies and trade unions have suggested that workplace exposure to nanoparticles could become the ‘next asbestos’.

The general public face exposure to nanoparticles and nanomaterials from a number of products containing nanoparticles that are already on the market, including: sunscreens, cosmetics, baby products, household paints and furniture varnishes, clothing, wound dressings, fuel catalysts, specialist automotive and aerospace components and even some food products.

As industrial production of nanomaterials expands, and greater quantities of nanoparticles are released into the environment, public exposure to nanomaterials will become increasingly widespread.

### ***Environmental Issues***

Nanotechnology threatens to intensify and exacerbate existing global environmental problems associated with industrial production, as well as to introduce distinctly new forms of environmental hazards.

A number of studies have begun to demonstrate that nanoparticles can be highly toxic to animals, plants and micro-organisms. Nano-structured particles and devices may constitute a whole new class of non-biodegradable pollutants, and may bio-accumulate within the food chain.

The intentional release of nanomaterials into the environment, for example for bioremediation, disinfection, agriculture or military purposes, is particularly concerning. The development and release of nano-engineered living organisms, and the prospect of self-replicating nano-devices, introduce another set of environmental risks with potential for significant ecosystem disruption.

Nanotechnology is likely to facilitate the next wave of growth and expansion in the industrial system, involving an increase in the quantity and range of commodities produced, and a corresponding increase in consumption of natural resources and generation of unwanted by-products of production.

### ***Economic and Equity Issues***

Nanotechnology is likely to transform all sectors of the economy and may lead to disruptive and profound economic changes within and between industrial sectors and labour markets. The question is not whether this is a good or bad thing per se, but that such technology-driven economic and social disruptions are likely to exacerbate existing inequalities rather than redress them.

As with the new biotechnologies, nanotechnology is an essentially corporate technology, in that it will largely be controlled by — and will facilitate the increased power of — large corporations. The corporate patenting, ownership and control of nanotechnological techniques and products is likely to facilitate the acceleration of corporate concentration within and across industrial sectors.

Nanotechnology will have a disruptive impact on existing industries, communities and workers — particularly in the countries of the South — as old technologies,

materials and worker skills are made redundant or undermined by nanotech processes and products.

Nanotechnology may thereby force changing patterns of work and skill requirements, changing material resource demands and changing geographical locations of production. The development of new nanomaterials may replace or undermine demand for other materials, and may therefore lead to declining prices for existing materials, declining incomes for workers, and a corresponding reduction in economic sovereignty.

### ***Military, Surveillance and other Issues***

The military sector is a key driver of nanotechnology research and development. In the United States, one of the world's largest investors in nanotechnology, it attracts more government funding than any other single sector. Such disproportionately large funding of nanotechnology military applications poses serious risks, including the potential for a new nano arms race.

Nanotechnology enables the development of ever more powerful and destructive weapons and applications, including a new generation of chemical and biological weapons. Nanotechnology will profoundly change all critical aspects of military capability, having a profound influence on the future balance of global power. A NATO Parliamentary Assembly Committee investigating the security implications of nanotechnology has warned that nanobioweaponry will significantly increase the risks associated with international terrorism.

Nanotechnology also enables the development of powerful new devices and processes for exercising centralised and pervasive control over individuals, such as in the form of ubiquitous surveillance and monitoring technologies.

### **Regulatory Issues**

To date governments have shown little inclination to adequately regulate the risks posed by nanotechnology, or to involve the community in decision-making about the technology that will reshape our world.

At present there are no government regulations and no regulatory bodies that specifically address nanotechnology in Australia. There are no regulations addressing the need for health and safety testing, workplace exposure, environmental assessment, approval for commercial release, labelling, or the post-release registration and monitoring of nano-materials and products.

Nanotechnology requires a new, separate and comprehensive regulatory framework — and a new and separate regulatory body — that are commensurate with its broad scope and huge transformative potential.

Nanotechnology requires an integrated regulatory framework for dealing with the range of health, ecological, economic, and socio-political issues that this technology

raises. Such an integrated framework would enable a consideration of the long-term outcomes; the common use of techniques and products across a range of sectors and applications; and the synergies between different applications.

The precautionary principle dictates that, given the limited testing and lack of understanding regarding the safety and toxicity of nanoparticles and other nano-products, the onus should be on industry and regulators to establish whether a product meets health, safety and ecological criteria before being approved for use and release.

## **Recommendations**

In recognising the wide range of hazards and risks associated with the release of nanomaterials into the environment and into human systems, coupled with the likely disruptive social and economic impacts of nanotechnology, Friends of the Earth call for a strongly precautionary approach to the development of nanotechnology.

We recognise that further scientific research on the health and environmental safety of nano-materials and products is required to inform the development of regulations to manage the risks of nanotoxicity. However, for even this non-commercial research work to proceed, precautionary protocols will be required to protect the health and safety of researchers and to strictly minimise any environmental releases.

In the absence of any established regulatory system, Friends of the Earth is calling for an immediate moratorium on all commercial research, development and release of nanotechnological materials and products.

We recommend the development of a comprehensive, national regulatory framework that specifically addresses issues of nanotoxicity as well as the broader social and ethical issues related to the research, manufacture, consumption and environmental release of nanotechnological products. Such a regulatory framework should include the following:

### ***Public participation in decision making***

A regulatory process should ensure the democratic control of and public participation in decision making on nanotechnology and other new technologies.

We recommend the initiation of a wide range of participatory processes, including those based on the deliberative design model, to enable direct “upstream” (i.e. early stage) input from the general public into new technology assessment, determination of research priorities, and determination of priorities and principles for public policy and legislation.

Stakeholder groups who will be impacted by nanotechnology (e.g. labour groups, public health organisations, disability rights advocates, civil liberties advocates, environmental organisations, specialist and industry organisations) should also be involved in public policy and regulatory development. Resources should be provided to enable participants to take part in these processes in a meaningful way.

## **Social and economic impact assessment**

The disruptive social and economic impacts of nanotechnology are likely to reach far further than hazards to human health and the environment.

We recommend an assessment process to ensure the development, application and control of nanotechnologies do not reinforce or create new forms of socio-economic inequalities, concentrations of wealth and power, means of social control and oppression, or weapons of destruction. These considerations must also directly inform the allocation of public funds for research and development.

## **Comprehensive and precautionary regulation**

We recommend the establishment of a regulatory regime involving comprehensive assessment of nanomaterials, and in which:

- all nano-materials and products are subjected to rigorous health and environmental impact assessment, including evidence based testing, prior to commercial production and/ or environmental release;
- due to the radically altered characteristics of nano materials compared to their larger scale counterparts, nano materials are assessed as new substances, even where the properties of larger scale counterparts are well-known;
- the assessments are based on the precautionary principle and the onus is on proponents to prove safety, rather than relying on an assumption of safety;
- risk assessment includes the entire life cycle of the products in question, from ‘cradle to grave’;
- all relevant data related to safety assessments, and the methodologies used to obtain them, are placed in the public domain;
- nanotechnological products are subjected to assessment to ensure the development, application and control of nanotechnologies do not reinforce or create new forms of socio-economic inequalities, concentrations of wealth and power, means of social control and oppression, or weapons of mass destruction
- nanotechnological products and research must also be subject to ethical assessment

In line with recommendations from the United Kingdom’s Royal Society and Royal Academy of Engineering’s 2004 report on nanotechnology, FoE Australia supports a prohibition on intentional releases of nanomaterials into the environment, including for remediation purposes.

Given the serious nature of risks to both environmental and human health, and the complex related ethical issues posed by the nano-manipulation of living organisms, FoE Australia supports a global ban on ‘synthetic biology’.