

Submission
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INQUIRY INTO NANOTECHNOLOGY IN NEW SOUTH WALES

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The Director
Standing Committee on State Development
Parliament House
Macquarie St
Sydney, NSW 2000

The Australian National Fabrication Facility (ANFF) welcomes the opportunity to contribute to the Inquiry into Nanotechnology in New South Wales.

ANFF has been funded under the National Collaborative Research Infrastructure Scheme (NCRIS) to provide access to state-of-the-art micro and nano fabrication facilities. Key recommendations are:

- 1) As an enabling platform, investment in nanotechnology is essential for competitiveness of NSW research and manufacturing sectors.
- 2) The diverse nature of nanotechnology products is best served by existing regulatory bodies and frameworks.
- 3) NSW Government should have active involvement in work of the type undertaken by NanoSafe Australia towards understanding the risks associated with nanomaterials.
- 4) Education is essential to reduce skill shortages and enable informed public discussion.

Rosie Hicks
CEO, ANFF

Current and future applications of nanotechnology for New South Wales industry and New South Wales community

In 2000, the National Science Foundation estimated that the market for nanotechnology products will be over one trillion US dollars by 2015. In fact, sales of basic nanomaterials such as carbon nanotubes and quantum dots will total only a fraction of this figure. Nanotechnology's economic impact will arise from how these fundamental building blocks are used. As such, nanofabrication will become a **dominant manufacturing technology** in the next 20 years. Applications of the technology span all of Australia's major research priorities: *Environmentally Sustainable Australia*, *Promoting and Maintaining Good Health*, *Frontier Technologies*, and *Safe Guarding Australia*.

Nanotechnology will have a major impact across a broad range of industry sectors including energy, water, communications, defence and the environment. For example:

- Nanostructured solar cells for low cost solar panels ;
- Nanostructure catalysis for efficient fuel cells;
- Development of nano-porous membranes for water purification;
- The ICT sector has already benefited from the use of nanostructures to create faster computer and communications chips;
- Controlled drug delivery, high-resolution medical imaging, bio implantable devices, and selective destruction of cancerous tumours are some of the examples of the use of nanotechnology in the medical field;
- RF products e.g., remote sensing and information reporting, advanced medical data systems, home entertainment distribution; and
- Green products e.g., low power electronics and white LEDs.

Retaining nanotechnology-based industry, research and development in NSW is vital for IP capture and subsequent wealth creation. Successful companies include CAP-XX, Peregrine Semiconductor Australia and Sirtex.

Innovation in NSW is underpinned by world class research facilities and centres of expertise. NSW is home to three nodes of the Australian National Fabrication Facility (ANFF): the Semiconductor Nanofabrication Facility (SNF) at UNSW; the Macquarie/ATP Node; and the Materials Node based at the University of Wollongong. Further, NSW hosts two nodes of the Australian Microscopy and Microanalysis Research Facility, including the headquarters at the University of Sydney. Together, these facilities have leveraged significant amounts of Australian Government funding under the National Research Infrastructure Strategy (NCRIS) to provide essential infrastructure to support world-class research outcomes and industry

The availability of nanofabrication and characterisation infrastructure and expertise make NSW an attractive location for nanotechnology-based industries, creating employment and economic demand. NSW has the potential to promote innovation and provide leadership in this field by ensuring a suitable regulatory environment.

The health, safety and environmental risks and benefits of nanotechnology

Nanotechnology provides a set of tools and processes that can be applied to many industry sectors with applications as diverse as new communications chips, lighter alloys, and bio-implantable devices. Some aspects have been harnessed for many years whilst the potential of others is only just being imagined. As with all new products, appropriate testing must be completed, to the same stringent standards as for other innovations.

However, it is vital to recognise that the mechanism by which these benefits are realised varies in each case. Most nanotechnology is associated with aggregate structures. For example, control of an alloy's composition at the nano scale enables us to modify the material's bulk properties. In contrast, it is the increased reactivity of gold nano particles that has led to their investigation as catalysts. Hence, testing must be specific and appropriate to the device or material. It is not possible to define a generic "nanotechnology testing regime."

The Royal Society report¹ noted that the majority of nanotechnologies have limited risks in terms of health, environment and safety. The report warns of the need to take precautions when dealing with engineered free nano particles, free nano tubes and use of nano particles in applications such as cosmetics until further studies provide more information about their affect on health, safety and the environment. Hence, to provide a safe working environment, standard laboratory practices for dealing with chemicals must apply.

As a national facility training operators, ANFF will be paying strict attention to OH&S best practice both for staff and external users of the facilities.

The appropriateness of the current regulatory frameworks in operation for the management of nano materials over their lifecycle

As noted above, the extremely diverse range of nanotechnology applications prevents the use of generic policies. Specific regulatory frameworks already exist for the introduction of new medical devices, new materials etc and these should be applied to the introduction of **all new products** as appropriate. It is not appropriate to create new frameworks for "nano products." Over regulation would be detrimental to the continued performance of NSW industry.

Continued research into the properties of materials will inform these existing regulatory bodies. It is important that NSW supports and invests in appropriate research. Further, engagement with bodies working to define protocols for nano materials, such as NanoSafe, is essential. NanoSafe's mission of providing quality data for the appropriate risk assessment of nanomaterials should be supported.

¹ *Nanoscience and nanotechnologies: opportunities and uncertainties*, London, The Royal Society, 2004

The adequacy of existing education and skills development opportunities related to nanotechnology

Nanotechnology sits at the intersection of disciplines including engineering, biochemistry and physics. As such, scientists working in nanotechnology need to be multi-skilled and capable of working across broad fields of activity.

New degree programs specifically for nanotechnology have been started at a number of NSW universities including UNSW, University of Wollongong, University of Technology Sydney and University of Western Sydney. However, there is a growing national and international demand for these graduates, which is a challenge for future developments in these areas. Significant shortfalls of suitably qualified scientists and engineers are forecast.

Underpinning successful access to research infrastructure is the availability of qualified **technical staff**. ANFF's role in promoting training opportunities for both users and staff across the nodes is useful. However, strategically a more formal coordinated training mechanism is desirable for technical staff.

Nanotechnology also has the potential to stimulate an interest in science amongst school children. Marketing to students/teachers in schools via targeted programmes to bring nanotechnology to the classroom is an important factor in attracting talented students to science and technology. Education is a vital component of the outreach programme necessary for informed public debate on nanotechnology.

Level of community understanding of nanotechnology and options to improve public awareness of nanotechnology issues

The sensationalist nature of some articles in the popular press demonstrates the level of public knowledge and concern regarding nanotechnology. These concerns can only be addressed by enhancing public understanding of the applications and risks of nanotechnology and promoting informed debate. In the short term, this will require an extensive outreach programme to avoid a backlash similar to that against genetically modified foods.

ANFF recognises the opportunities that it has as an organisation to contribute to increasing public awareness through outreach activities. It is strongly recommended that NSW Government invest in programs to increase public awareness of the benefits and risks of nanotechnology.