

## INQUIRY INTO NANOTECHNOLOGY IN NEW SOUTH WALES

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**Inquiry into Nanotechnology in New South Wales.**  
**Submission by University of Wollongong**

This submission addresses the issues confronting Nanotechnology and obstacles to its potential uses and the benefits for NSW against the terms of reference of the State Government inquiry

- a. *Current and Future Applications of Nanotechnology.* Nanotechnology is an emerging field of science and engineering engaged with the understanding and manipulation of materials structured at the nano-scale ( 0.001 micron). This research area will bring about major improvements in technology in a great variety of applications. These include water supply and security, sustainable energy needs, adaptive materials, biomedical applications and nano-medicine. These technological advances present great opportunities for NSW Industry provided the conditions are right to foster R&D and start-up companies. Commercialisation of nanotech products is highly competitive and governments have a role in fostering rapid transition from lab to market with proper regard for safety and ethical issues. The complex interactions between research providers, existing and start-up companies, government departments, venture capitalists and intellectual property agents can greatly slow down commercialisation activities. States that facilitate a co-ordinated approach to commercialisation will be most attractive for new businesses built around nanotech discoveries.

Nanotechnology will have a major impact on the NSW Community over the next 20-30 years in all aspects of people's daily lives. Nanotechnology encompasses an enormously wide variety of materials, techniques, products and applications. While the benefits for consumers will be seen in a wide range of new products and processes, it seems that NSW would be best served by selecting particular niche nanotechnologies to support through research and commercialisation. Important benefits will accrue from a concentration of research and commercialisation efforts in particular areas, thereby increasing the likelihood of new businesses emerging in NSW and the development of world-leading expertise. For example, the Australian Centre for Electromaterials Science (ACES) at the University of Wollongong, is a leading research Centre specialising in making and using nanomaterials for applications in energy conversion and storage and bionics – see web link for more details (<http://www.electromaterials.edu.au/>)

- b. *Health, Safety and Environmental Risks and Benefits of Nanotechnology.* There is currently much research being carried out around the world including some in Australia on potential risk posed by nano-sized materials. It is clear that in a lot of cases of the hazards are similar to other forms of the material. For end-users the nanomaterials are often embedded in composite materials. For example, nanometre sized carbon has been used for over 100 years to reinforce rubber in car tyres, without any known adverse affects on people's health. However, in other cases the release of nano-sized asbestos particles from a cement matrix is now known to cause serious health problems. Particular care and further research needs to address the potential issue of nanomaterials in all products, especially foods and personal care products applied to the skin. The characterisation of the properties of materials at the

nanoscale is generally “investigator-driven” (ie the result of scientists seeking to find out whether a particular material has potentially interesting properties at the nanoscale). Therefore, it is likely that toxicological, safety and environmental studies that occur in step with the move from laboratory-based studies to the production stage will more effectively identify potential health and environmental risks than those that attempt to assess safety in advance of the basic scientific investigation. Further, because relevant safety and environmental risks will emerge from the particular form and interactions between materials in a particular application, a case-by-case approach is needed for approving the application of products incorporating nano-particles.

- c. *Current regulatory Frameworks.* The prevailing view including that of the Federal Government Agencies is that the existing frameworks will be able to handle the management of nanomaterials over their lifecycle. There will of course be a need to continue to carry out risk assessment and monitoring to ensure unforeseen hazards and problems are captured. Regulatory consistency between jurisdictions, both nationally and internationally will be important to ensure that regulation is adequate and to avoid unnecessary duplication. It is important that the any modifications to regulations do not unnecessarily hamper research in the area. In a rapidly moving field, opportunities can be easily lost if the regulatory hurdles impede researchers. A recent book (Hodge, et al (eds) *New Global Frontiers in Regulation: The Age of Nanotechnology.* Edward Elgar Publishing, UK 2008), raises the range of issues confronting regulators in this area.
- d. *Adequacy of Existing Education and skills development.* University of Wollongong has an excellent undergraduate program in Nanotechnology. This focuses on the University’s research strengths in Materials Chemistry and provides a stream of quality graduate for research and other employment opportunities. Nanotechnology researchers principally come from conventional discipline areas of chemistry, materials science, physics and biology. While these areas will remain important, the multidisciplinary nature of nanotechnology also demands a new type of science education: one that blends these conventional areas and allows graduates to cross the discipline boundaries. Our program differs some what from those elsewhere in NSW (eg UWS, UTS and UNSW) in that it is focussed on giving students exposure and access to cutting edge researchers from year 1. This approach also integrates an introduction to the emerging societal and ethical implications of nanotechnology at all undergraduate and post-graduate levels, continuing through to Early Career Research. As such, the undergraduate program articulates well with the research activities and several of the graduates have already taken PhD scholarships with nanotech labs at UOW and other universities. The UOW nanotech degree attracts students with good backgrounds in Chemistry, Physics and Mathematics – all subjects that are suffering (enabling Sciences) in schools in NSW. There are great opportunities for students to learn basic science at schools and at tertiary level by using Nanotechnology as an exciting vehicle for multidisciplinary science. The Board of Studies for example could use it to catalyse more interest in the enabling sciences at school and amongst teachers. What is critically needed is

better marketing and advertising of these areas to Schools. This is needed to maintain and boost numbers in this emerging field to meet future demand for practitioners with these skills.

- e. *National Nanotechnology Strategy (NNS) and NSW* : The aims of the NNS are to assist Australia to capture the potential benefits of nanotechnology while effectively addressing the issues impacting on the successful and responsible development of the technology. A whole of Government approach is suggested in order that Australia seizes the opportunities and reaping the benefits of the already outstanding research and development that is taking place in Australia. This needs to be done by encouraging the uptake and use of nanotechnology based materials, products, and services by industry and to achieve increased competitiveness based on understanding of the potential and risks in nanotechnology. As mentioned under point a) we recommend that particular areas of nanotechnology are targeted for support within NSW. In addition, another aim of the NNS is to build public confidence in nanotechnology products and services based on balanced and factual information about nanotechnology and through opening-up opportunities for informed public discussion of the social, economic and health benefits, risks and potential impact of nanotechnology in NSW. The NSW Government can play very important roles in both these areas. This will ensure that good progress is made in developing nano-materials, products and companies for the use and benefit of all the people of NSW and its economy.
- f. *Community understanding.* UoW through ACES have an education program within its mandate. This education program has two aspects: on the one hand it promotes discussion and debate among established, early career and student researchers to promote socially aware, responsible science and on the other it provides outreach to the general community. ACES are presently developing an interactive exhibit in collaboration with the Science Centre at Wollongong to showcase the possibilities of Nano-materials to the General community. When completed this exhibit will be able to be taken on tour to other Centres. In order to communicate more to the general community further involvement and funding from State Agencies would be vital. In addition, there is a great need to look at School education for opportunities to use Nanotechnology to excite students about science as well as informing the next generation to be scientifically and Nano literate.