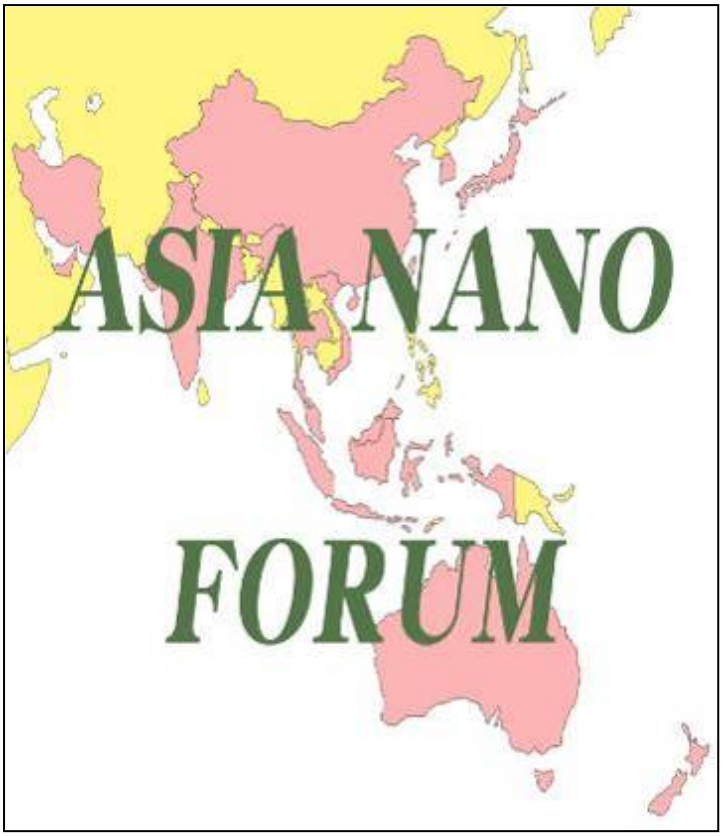


ASIA NANO FORUM NEWSLETTER

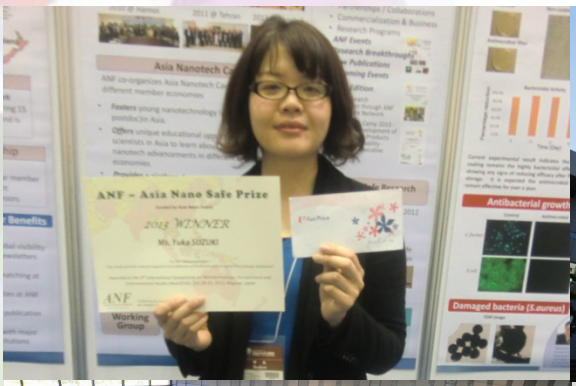
(ISSUE 22 - Special Edition)

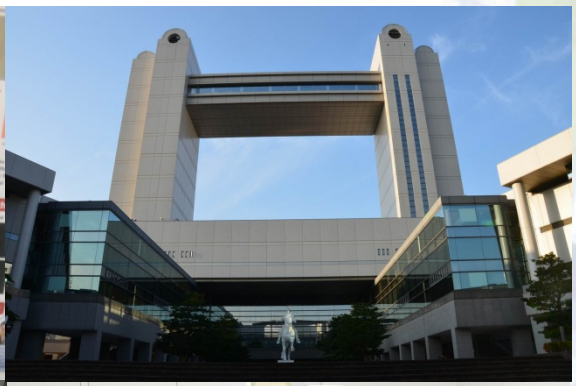
ANF Asia Nano Safe Network

ANF Secretariat, Singapore
March 2014

Editor:

Paul WRIGHT (RMIT, Australia)
Founding Co-ordinator of Asia Nano Safe





ASIA NANO FORUM SOCIETY NEWSLETTER
SPECIAL EDITION: ANF Asia Nano Safe Network ISSUE No. 22 March 2014

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Greetings from the ANF Asia Nano Safe Network

Welcome to the nanosafety special topic issue of the ANF society newsletter. 2013 was certainly a very busy and productive year for nanosafety-related activities in ANF-member economies.

What started as a major new initiative endorsed by the very successful ANF Summit (ANFoS2012) held in Bangkok, Thailand in August 2012, quickly led to the establishment of the Asia Nano Safe network at its "kick off" workshop, held in Tokyo in January 2013 during Nano Tech 2013 Japan. This event was rapidly followed by the confirmation of local nanosafety champions in ANF-member economies, and setting up of the nanosafety webpages and database on the ANF website. The year's nanosafety activities culminated in several ANF Asia Nano Safe events during the highly successful 6th International Symposium on Nanotechnology, Occupational and Environmental Health (NanOEH6) held in Nagoya, Japan in October 2013. Noteably, NanOEH6 was the occasion for the awarding of the inaugural ANF-Asia Nano Safe prize (funded by ANF in 2013) for the best nanosafety presentation by a research student from an ANF-member economy.

With the rapid establishment and development of ANF's nanosafety initiative last year, it is very appropriate in early 2014 for this special nanosafety edition of the ANF newsletter to provide an overview of these nanosafety activities and information gathered during 2013, a period which one could justifiably call the "ANF Year of Nanosafety"!

I am extremely thankful to all of the contributors to this special issue, especially Hongfang JIN and Lerwen LIU of the ANF Secretariat in Singapore. I hope you find this special issue informative and interesting, and look forward to your ongoing involvement and support to continue the momentum from these strong beginnings.

Best regards,
Paul WRIGHT (RMIT, Australia)
Founding Co-ordinator of ANF Asia Nano Safe Network

The Move to Establish the ANF Asia Nano Safe Network

(Source: Paul WRIGHT "Asia Nano Safe: A new international nanosafety research network", NanOEH6 Program/Abstract Book, abstract O-30-A-21, page 37; http://square.umin.ac.jp/nanoeh6/)

Nanosafety has a major role in the sustainable development of nanotechnology. Smart development of nanotechnology is needed in order to harness the potential benefits of nano-enabled applications for providing a greener, healthier lifestyle. This value-adding process for nanoproducts involves: the safety-by-design approach for their whole life-cycle; built-in recycling options; and re-engineering nanomaterials to reduce potential hazard. It is also important to remember that some modifications may also affect the functionality of the nanomaterial.

There is clear evidence within the Asian economies of a long history and extensive expertise in nanosafety research, with considerable resources and support. There has also been extensive Asian involvement in nano-specific procedures being introduced by international and local regulatory authorities, including development of ISO standards and the nanosafety testing program of the OECD Working Party on Manufactured Nanomaterials (WPMN).

The urgent need for co-ordinated nanosafety research activities in Asia was repeatedly raised during both the ANF Summit (ANFoS2012) and the 1st ANF Summit Technical Seminar Program on "Nano Labeling and Safety Issues" and "Green Nanotechnology", held in August 2012 in Thailand and jointly organized by NANOTEC and ANF. Addressing this need directly aligns with ANF's mission: "To promote responsible research and development of nanotechnology that educationally, socially, environmentally and economically benefits each economy by fostering international network and collaboration". Consequently, a major new initiative was endorsed at ANFoS2012, championed and co-ordinated by Australia as a contributing ANF-member economy – this being the establishment of a new Asian nanosafety research network.

Photo of 1st ANF Summit Technical Seminar by NANOTEC

Thus, the new nanosafety research network of Asia Nano Safe was established under the auspices of the ANF with a "kick off" workshop during the world's largest annual nanotechnology fair of Nano Tech 2013. The network aims to facilitate nanosafety research and capability in the Asian region. The network includes academic and industry R&D players and government regulatory bodies, linked through local nanosafety champions representing ANF's 15 member economies: Australia, China, Hong Kong, India, Indonesia, Iran, Japan, Malaysia, New Zealand, Singapore, South Korea, Taiwan, Thailand, UAE and Vietnam.

The Asia Nano Safe network aims to assist in: co-ordinating nanosafety activities in the Asian region that are currently fragmented, to minimise unnecessary duplication of effort; providing a co-ordinated response for community concerns and engagement; and harmonization of nanosafety training and the safety-by-design approach to nanotechnology development, and translational nanoresearch to the marketplace.

ANF Nanosafety Workshop: Asia Nano Safe "Kick Off" Workshop

(Source: Paul Wright "Summary of ANF Nanosafety Workshop", ANF Exec. & Annual Reports 2013)

As a follow up to ANFoS2012, the Asia Nano Safe "kick off" workshop was held in Tokyo Big Sight during Nano Tech Japan 2013 (Jan. 31, 2013), to establish the Asia Nano Safe network. This ANF workshop was financially supported by the University of Tokyo. Welcome remarks were delivered by Dr Masahiro TAKEMURA (Secretary of ANF, Japan), representing the host economy of Japan, in which he highlighted that this workshop was being held during the biggest international nanotechnology conference annually, involving 50,000 registrants over 3 days. He also indicated the significant investment that the Japanese government has made towards nanosafety (equivalent to US$10M within the government ministries of METI, MEXT, MHLW and MOE).

Opening remarks were given by Assoc. Prof. Paul WRIGHT (Asia Nano Safe Co-ordinator, Australia), emphasizing the role of nanosafety in the sustainable development of nanotechnology. He also gave an overview (i.e. the "Why, What and Where") of the Asia Nano Safe research network initiative, which is an important outcome of the recent ANFoS2012.

Photos of Asia Nano Safe "Kick Off" Workshop by JIN Hongfang, ANF Secretariat, Singapore

Each representative of the 10 member economies present at the workshop delivered a brief overview of the nanosafety research and facilities in their member economy. Two-thirds of the 15 economy constituency of ANF were represented (see table below). In addition to the strong evidence of Asia's extensive expertise in nanosafety research and nano-related standards development (see previous section), some common themes were identified by the presenters, including: the recognition of the importance of nanocharacterization for good nanosafety and nanotoxicology research; the workplace and environmental nano-related issues; and nanovector and nanoethics issues.

ANF Member Economy	Nanosafety Presenter
Australia	Assoc. Prof. Paul WRIGHT, RMIT University and Nanosafe Australia
China	Prof. Qiangbin WANG, Suzhou Institute of Nano-Tech and Nano-Bionics; Chinese Academy of Sciences
Iran	Prof. Ali BEITOLLAHI, Iran University of Science and Technology; Director of International Collaboration and Standardization Committee, INIC, Iran
Japan	Prof. Gaku ICHIHARA, Nagoya University
Korea	Prof. Il Je YU, Institute of Nanoproduct Safety Research, Hoseo University
Malaysia	Dr Rezal Khairi AHMAD, NanoMalaysia
New Zealand	Dr Sally GAW, MacDiarmid Institute and University of Canterbury
Singapore	Dr Ramam AKKIPEDDI, Institute of Materials Research and Engineering, A*Star
Taiwan	Prof. Gwo-Bin LEE, National Tsing Hua University
Thailand	Prof. Sirirurg SONGSIVILAI, NANOTEC

Representatives were then divided into two groups for the break-out discussion group session aimed at identifying priority engineered nanomaterials in Asia for immediate nanosafety screening, along with potential funding sources. In summary, some ANF-member economies have provided reference and test materials for the OECD WPMN. Nanomaterials of current and future industrial importance were listed: graphene, magnetic nanoparticles and reference nanomaterials (i.e. the current limited range needs to be expanded and include development of standard reference materials); also mentioned were quantum dots, Ag, Al, metal oxides (TiO_2, CeO_2) and CNTs.

Other important issues were raised, including: that Asian nanosafety testing should not duplicate OECD or EU efforts; the need for co-ordination between expert laboratories; and that some economies have had recent boosts in funding and testing facilities. Dr Lerwen LIU (Secretary of ANF, Singapore) also explained the development of a spreadsheet summary table for ANF members to indicate the nanomaterials of interest being tested and the nanotechnology-related capabilities being used (the "ANF-EHS Database spreadsheet").

The workshop also had a planning session led by Prof. Gaku ICHIHARA (Nagoya University, Japan) for discussing the format of the Asia Nano Safe symposium at NanOEH6 (detailed in the next section), in which there was general support for instituting the inaugural ANF-Asia Nano Safe prize proposed by Paul WRIGHT. The general discussion and closing remarks made by Paul WRIGHT concerned the way forward for Asia Nano Safe. The next steps were outlined, including the following nanosafety-related activities leading up to NanOEH6:

- Confirmation of local nanosafety champions of the ANF member economies, which has occurred along with some replacements and alternate representatives.
- Opening of nanosafety webpages on the ANF website (www.asia-anf.org/), with ongoing development and expansion of the searchable ANF Nanosafety Network EHS Database. This lists the nanosafety research capabilities and key players of ANF member economies to assist our future activities of fostering nanosafety research collaborations, sharing resources, education and training.
- The very successful ANF Asia Nanotech Camp organized by ANF and Surya University on the nanosafety-related theme of "Responsible development of nanotechnology products enabling sustainability", and held in Serpong, Indonesia in Oct. 2013 (for details refer to the *"ANF Newsletter Special Edition – Issue 21"*).

ANF-Asia Nano Safe activities at NanOEH6

(Source: Paul Wright "Summary of ANF activities at NanOEH6", ANF Exec. & Annual Reports 2013)

The International Symposium on Nanotechnology, Occupational and Environmental Health is an important biennial nanosafety-related conference, with the NanOEH6 recently held at the Nagoya Congress Center, Nagoya, Japan on Oct. 28-31, 2013. This 4 day conference involved 257 participants and 250 presentations (including 119 oral and 131 posters, available from *http://square.umin.ac.jp/nanoeh6/*). The conference chairperson, Prof. Gaku ICHIHARA (Nagoya University, Japan) and the NanOEH6 Planning, Scientific and Japan Committees structured the conference program to help address the following fundamental questions regarding the safety of nanomaterials:

- Can we design safer nanomaterials?
- Can we ensure the safety of workers with the currently limited data on nanomaterial safety?
- What is the appropriate dose-metric(s) for setting the safety standards in the workplace?

Photos of the Nagoya Congress Center (above) and NanOEH6 delegates (below) by Prof. Harald KRUG, Switzerland

There were several Asia Nano Safe activities at NanOEH6, including:

- Asia Nano Safe co-ordinator (WRIGHT) was an invited member of NanOEH6 Scientific Committee, and contributed to program development and abstract review processes.
  - A brief follow-up business meeting of ANF nanosafety representatives to discuss their economy's nanosafety priorities and future activities for Asia Nano Safe (Oct. 28 onwards), these included: Australia (Assoc. Prof. Paul WRIGHT); Iran (Prof. Mahmoud GHAZI-KHANSARI); Japan (Prof. Gaku ICHIHARA, Dr Masahiro TAKEMURA); Korea (Prof. Il Je YU); Taiwan (Prof. Chuen-Jinn TSAI); Singapore (post-conference meeting at ANF HQ, Dr Ramam AKKIPEDDI, Dr Lerwen LIU).
  - A symposia session "Collaboration session with Asia Nano Forum - Asia Nano Safe" (Oct. 30), chaired by the Assoc. Prof. Paul WRIGHT. The session commenced with a presentation by Asia Nano Safe co-ordinator (WRIGHT) titled "Asia Nano Safe: A New Nanosafety Research Network", followed by the shortlisted research student oral presentations for the inaugural ANF-Asia Nano Safe prize (see the next section).
  - The International Collaboration panel discussion in the Satellite Symposium at the end of NanOEH6 (Oct. 31), was chaired by MARINA co-ordinator (Prof. Lang TRAN, IOM) and included the Asia Nano Safe co-ordinator, along with other network co-ordinators and representatives from Japan, Europe and North America.

Photo of the International Collaboration panel discussion by Prof. Harald KRUG, Switzerland

Inaugural ANF-Asia Nano Safe prize

(Source: Paul Wright "Summary of ANF activities at NanOEH6", ANF Exec. & Annual Reports 2013)

NanOEH6 was also the occasion for the awarding of the inaugural ANF-Asia Nano Safe prize (funded by ANF in 2013) for the best nanosafety presentation by a research student from an ANF-member economy.

A rigorous judging process was followed. All submitted conference abstracts were evaluated and scored by members of the NanOEH6 Planning, Scientific and Japan Committees, with the higher ranking abstracts submitted for oral presentation confirmed as orals. Of these, 4 nanosafety-related abstracts from research students in ANF-member economies were short-listed and delivered in the "Collaboration session with Asia Nano Forum - Asia Nano Safe" (Oct. 30). Orals were judged on presentation structure, content, style, clarity and handling of questions.

The 2013 Prizewinner (receiving a certificate and US$500) and runner-up (receiving a certificate) were announced by WRIGHT during the NanOEH6 Meeting Wrap-Up session (Oct. 31). These were as follows (with their abstracts on the following pages):

ANF-Asia Nano Safe Prize Winner for 2013:
Ms. Yuka SUZUKI
(Mie University, Japan)

Photo by JIN Hongfang, ANF Secretariat, Singapore

Runner-up for 2013:
Mr. Vipin ADAVAN KILIYANKIL
(Hokkaido University, Japan)

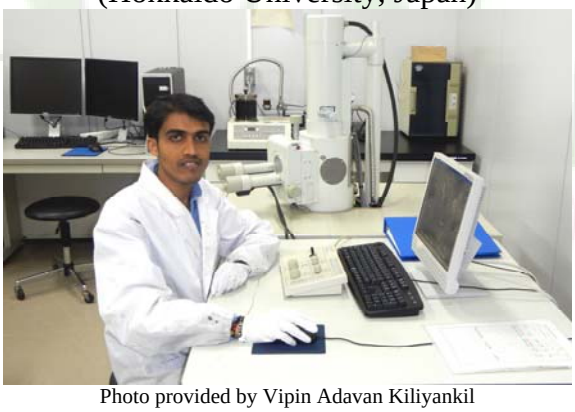


Photo provided by Vipin Adavan Kiliyankil

The other two short-listed orals were:

Mr. Xu Hong CHANG (Southeast University, China) for "Subacute pulmonary toxicity induced by intra-tracheal instillation nano TiO_2 in rats".

Mr. Yosuke KOYAMA (Kyoto University, Japan) for "Assessment of radiation exposure from inhaled particles in waste incineration plants".

"Zinc oxide particles induced migration and adhesion of monocytes and increased macrophage cholesterol."

Yuka Suzuki[1], Saeko Tada-Oikawa[1], Gaku Ichihara[2], Kiyoshi Sakai[3], Masayuki Yabata[1], Kiyora Izuoka[1], Sahoko Ichihara[1]

[1] Mie University, Japan; [2] Nagoya University Graduate School of Medicine, Japan; [3] Nagoya City Public Health Research Institute, Japan.

Background: Metal oxide nanoparticles have been widely used in industry, cosmetics, as well as biomedicine. However, the correlation between exposure to metal oxide nanoparticles and the increased incidence of cardiovascular disease remains unknown. The present study investigated the migration and adhesion of monocytes and macrophage cholesterol uptake, that are essential processes for atherosclerotic progression, induced by nano-sized metal oxide particles.
Methods and Results: Human umbilical vein endothelial cells (HUVECs) were cultured and exposed to nanosized TiO_2 and ZnO particles. The 21 hours exposure to ZnO increased the level of monocyte chemotactic protein-1 (MCP-1) and cell migration mediated by MCP-1 was observed using human monocytic leukemia (THP-1). We also investigated the effect of nano-sized TiO_2 and ZnO particles on cholesterol uptake in THP-1 macrophages after stimulation with acetylated-LDL. The exposure to ZnO up-regulated the expression of membrane scavenger receptors of modified LDL particles and increased cholesterol uptake whereas there were no changes by the exposure to TiO_2.
Conclusions: The exposure to ZnO induced THP-1 cell migration and increased macrophage cholesterol uptake. The study indicates that nano-sized ZnO particles accelerate foam cell formation in THP-1 macrophages.

Reproduced from NanOEH6 Program/Abstract Book (abstract O-30-A-25, page 39).
Available at http://square.umin.ac.jp/nanoeh6/ accessed 28/3/14).

"Prussian blue caged in alginate/calcium beads for removal of cesium and strontium ions from water."

Vipin Adavan Kiliyankil, Baiyang Hu, Bunshi Fugetsu

Hokkaido University, Japan

Radioactive cesium and strontium are the two principle fission products responsible for most of the radioactivity of spent fuel after several years of cooling. Insoluble Prussian blue (PB) encapsulated alginate beads reinforced with highly dispersed carbon nanotubes were prepared for the safe removal of cesium and strontium ions from aqueous solutions. The composite adsorbent showed high physicochemical stability in solutions with high ionic strength. Batch equilibrium and kinetic studies were carried out to understand removal capability as well as sorption mechanism. From different isothermal analyses the goodness of mathematical fitting of the experimental data were in the order Langmuir > Freundlich, and that of the kinetic models were in the order of pseudo second order > pseudo first order. The beads showed remarkable adsorption capacity. In addition, from the studies on the effect of pH and ionic competition, we could understand that the adsorption ability remain unaffected in a wide range of values. Fixed bed adsorption column analysis showed that the beads could be appropriate for industrial scale treatment of cesium and strontium contaminated water. Therefore, the new composite beads should be a promising material for the contemporary environmental problems associated with radioactive contamination.

Reproduced from NanOEH6 Program/Abstract Book (abstract O-30-A-23, page 38).
Available at http://square.umin.ac.jp/nanoeh6/ accessed 28/3/14).

ANF Member Economy-Specific Nanosafety Information

This section includes a compilation of the EHS Database information to date. Please go to www.asia-anf.org/ to obtain further details and updates of the ANF-EHS database. Other ANF-member economies not shown in this section will feature on the website in future.

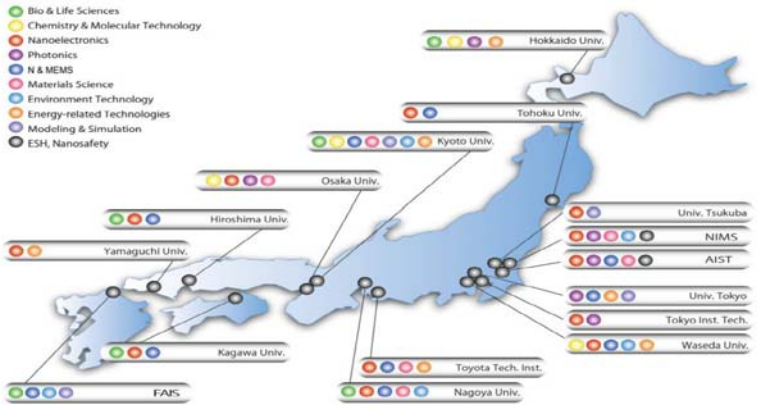
Australia

AUSTRALIA (excerpt of current ANF-EHS database information)
Nanosafety Point Of Contact: Assoc. Prof. Paul WRIGHT (RMIT University and Co-ordinator of Nanosafe Australia; paul.wright@rmit.edu.au)
Potential Funding Agencies for Research Linkages within Asia: Australian Commonwealth Department of Industry (formerly DIICCSRTE, including support for collaborations with China, India, Japan, Korea, Singapore, Taiwan and New Zealand); Australia-China Science and Research Fund (ACSRF); Australia-India Strategic Research Fund (AISRF); Australian Research Council (ARC), Discovery and Linkage Projects; National Health and Medical Research Council (NHMRC).
Nanosafety Network/Initiative: NanoSafety Australia
Network Website: www.rmit.edu.au/nanosafe
Nanosafety Research Expertise: Green chemistry design, synthesis and manufacture of nanomaterials; Characterisation of physico-chemical properties; Nanometrology; Measurement of ultra-fine particles in ambient air; Toxicokinetics of particles; Pre-clinical safety testing; Immuno-, neuro- and biochemical toxicology; Occupational and food allergy; Occupational hygiene, workplace monitoring and work health and safety; Ecotoxicology, nanovectors, environmental toxicology and contamination; Ecological and human health risk assessments; Risk management, perception and communication.
Facilities used for Nanosafety Research: National research infrastructure programs (NCRIS, A$500M, 2006-13): Computational science - National Computational Infrastructure; Nanofabrication - Australian National Fabrication Facility (ANFF, including Melbourne Centre for Nanofabrication, UNSW and ANU); Nanocharacterisation - Australian Microscopy and Microanalysis Research Facility (AMMRF) and Australian Synchrotron (XRD, SAXS, XAS, XFM; soft X-ray photoelectron spectroscopy and low-energy XAS); Nanometrology - National Measurement Institute's Nanometrology Section (NMI, with AFM; particle size analysis by laser diffraction, microchannel resonator, disk centrifuge, DLS, Nanosight, AFFFF; surface area analysis by liquid, gas adsorption; zeta potential, etc.).
Priority Nanomaterials for Nanosafety Research: ZnO and TiO_2 (especially sunscreen nanoparticles), CeO_2, Ag, CNTs, graphene
International Collaborations: Several international collaborations; most notably (1) the Australian Consortium's contribution to the nanosafety testing programme of the OECD Working Party on Manufactured Nanomaterials (WPMN), specifically for silver, zinc oxide and ceria test nanomaterials; and (2) ANF-EHS Program.
OECD Member: yes
ISO Member: yes
Nanosafety Experts: (details of expertise, email and web addresses are shown in ANF-EHS database at www.asia-anf.org/) Heads of Research Groups: Assoc. Prof. Paul Wright, RMIT University (Co-ordinator of Nanosafe Australia); Dr Maxine McCall, CSIRO; Dr Victoria Coleman, National Measurement Institute (NMI); Prof. Terry Turney, Monash University; Assoc. Prof. Takuya Tsuzuki, Australian National University (ANU); Em. Prof. Brian Gulson, Macquarie University; Prof. Lidia Morawska, Queensland University of Technology (QUT); Dr Howard Morris, Safe Work Australia; Prof. Mike McLaughlin, University of Adelaide; Prof. Mike Roberts, Univ. of Queensland and University of South Australia.

Iran

IRAN (excerpt of current ANF-EHS database information)
Nanosafety Point Of Contact: Prof. Ali BEITOLLAHI (Iran University of Science and Technology; beitolla@iust.ac.ir)
Nanosafety Network/Initiative: Iran Nanosafety Network
Network Website: www.nanosafety.ir
Nanosafety Research Expertise: Nanomaterials waste management; Monitoring and fingerprinting of nanomaterials in aqueous ecosystems (Case study: Band Ali Khan wetlands); Identification, analysis and management of engineered nanomaterials at universities and research centers (Case study: Tehran city); National program for nanosafety promotion in agriculture and natural resources; Effects of size and surface charge of nanoliposomes on their cytotoxicity; Determination of releasing nanosilver from poly-ethylene food packaging: Test method.
Facilities used for Nanosafety Research: National program for nanotechnology development, Iran Nanotechnology Initiative Council; Ministry of Health and Medical Education.
Priority Nanomaterials for Nanosafety Research: Ag, TiO_2, ZnO nanoparticles, Nanoclays, CNTs
OECD Member: no
ISO Member: yes
Nanosafety Experts: (details of expertise, email and web addresses are shown in ANF-EHS database at www.asia-anf.org/) Prof. Ali Beitollahi, Iran University of Science and Technology; Prof. Mahmoud Ghazikhansari, Tehran University of Medical Science; Prof.Alireza Ghassempour, Shahid Behashti University; Prof. Hasan Shirazi, Shahid Behashti University of Medical Sciences; Dr. Mohammad Kazem Kooohi, Tehran University; Dr. Behrooz Akbari, Ministry of Health and Medical Education; Dr. Hormozi Nezhad, Sharif University of Technology; Dr. Seyed Hosein Hashemi, Shahid Beheshti University; Dr. Shahnaz Bakand, Iran University of Medical Science.

Japan

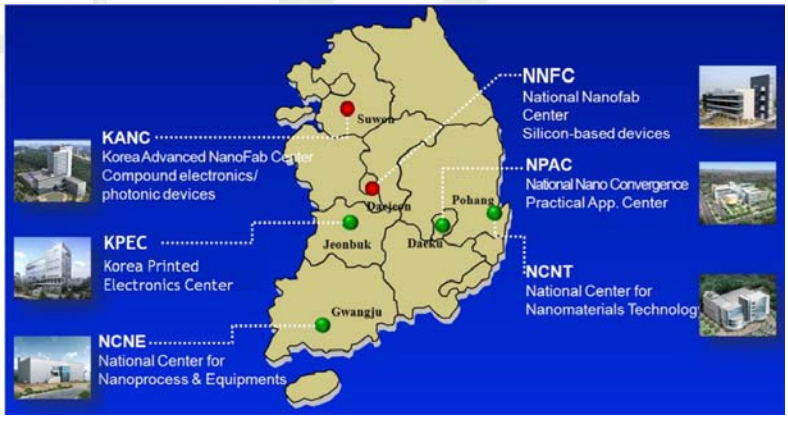


Japan's Nanotechnology Platform (from MEXT, Japan)

JAPAN (excerpt of current ANF-EHS database information)
Nanosafety Point Of Contact: Prof. Gaku ICHIHARA (Nagoya University; gak@med.nagoya-u.ac.jp)
Potential Funding Agencies for Research Linkages within Asia: Ministry of Economy, Trade and Industry (METI), Ministry of Health, Labour and Welfare (MHLW), Ministry of Environment (MOE), Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan Science and Technology Agency (JST), Japan Society for the Promotion of Science (JSPS).

Nanosafety Research Expertise: Characterization of nanomaterials, Occupational and Environmental Health, Toxicologic Pathology, Oncology, Neurotoxicology, Cardiovascular toxicology, Exposure assessment of manufactured nanomaterials, Occupational Epidemiology, Environmental toxicology, Biological monitoring, Toxicokinetics, Inhalation toxicology, Immunotoxicology, Reproductive and developmental toxicology, Neuroendcrinology, Risk assessment, Risk management and communication.
Facilities used for Nanosafety Research: Characterization, Electron microscope, DLS, Nanomanufacturing - National Institute for Materials Science; Exposure assessment and Inhalation exposure - National Institute for Environmental Studies; Inhalation system, animal experiments and *in vitro* experiments - National Institute of Health Sciences; Exposure assessment - National Institute of Occupational Safety and Health; Inhalation system - University of Occupational and Environmental Health; Inhalation system, animal experimentation and *in vitro* experimentation -Tokyo University of Science; Drug delivery system - University of Tokyo.
Priority Nanomaterials for Nanosafety Research: ZnO, TiO_2, CNTs, Au
International Collaborations: International Alliance for Nano EHS Harmonization (IANH), Management of Risks of Nanomaterials (MARINA).
OECD Member: yes
ISO Member: yes
Nanosafety Experts: (details of expertise, email and web addresses are shown in ANF-EHS database at www.asia-anf.org/) Heads of Research Groups: Dr Jun Kanno, National Institute of Health Sciences; Dr Seishiro Hirano, National Institute for Environmental Studies; Dr Shigeki Koda, National Institute of Occupational Safety and Health; Dr Kunichi Miyazawa, National Institute for Materials Science; Dr Masashi Gamo, National Institute of Advanced Industrial Science and Technology; Prof. Shoji Fukushima, Japan Bioassay Research Center; Prof. Toshihiko Myojo, University of Occupational and Environmental Health; Prof. Gaku Ichihara, Nagoya University.

Korea



Korea's 6 Nano-infrastructure Centers (www.kontrs.or.kr)

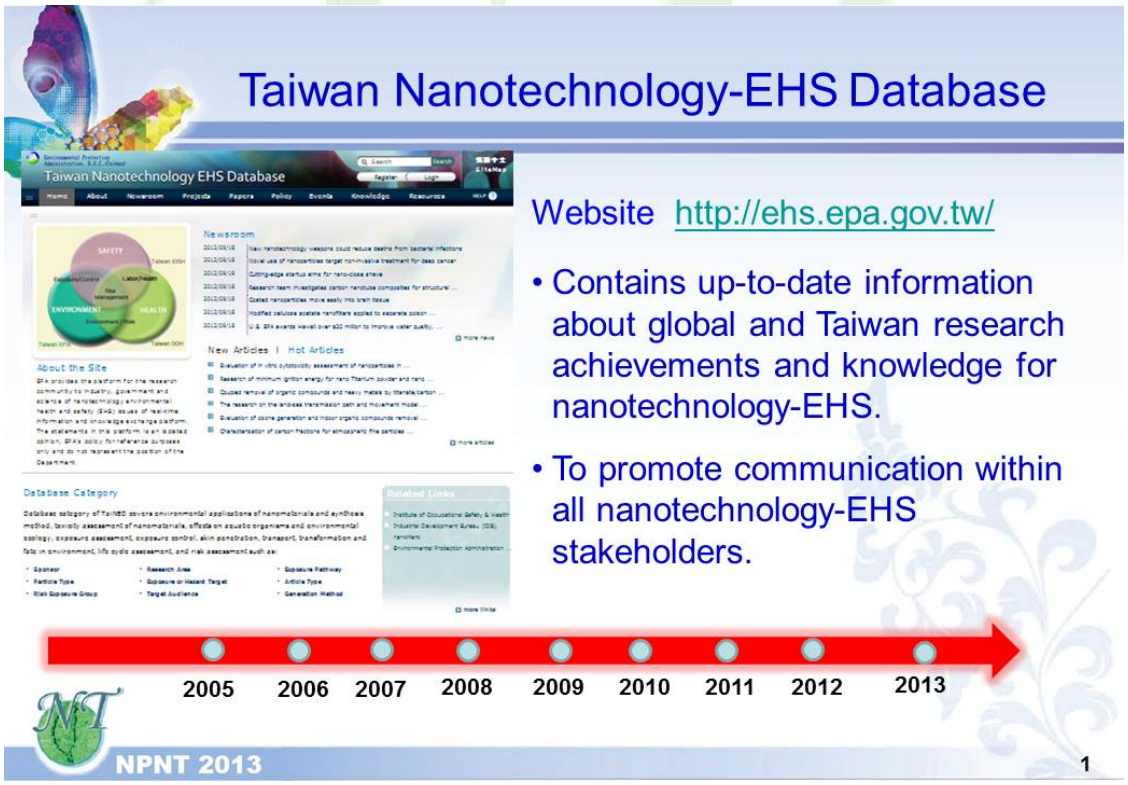
KOREA (excerpt of current ANF-EHS database information)
Nanosafety Point Of Contact: Prof. Il Je YU (Institute of Nanoproduct Safety Research, Hoseo University; u1670916@chol.com)
Potential Funding Agencies for Research Linkages within Asia: Green Nano Technology & Nano Original Technology Development - Korea Research Foundation, Ministry of Science, ICT and Future Planning; Nanoproduct Safety Foundation Technology Development & Nanosafety Platform - Ministry of Commerce, Industry and Energy; Eco-technopia 21 project - Ministry of Environment; Development of Nanosafety Technology - Ministry of Food and Drug Safety.
Nanosafety Network/Initiative: Nanosafety Management Comprehensive Plan
Network Website: www.kontrs.or.kr, www.nanokorea.net, www.nanoin.org

Nanosafety Research Expertise: Green chemistry design, synthesis and manufacture of nanomaterials; Characterisation of physico-chemical properties; Exposure assessment of nanoparticles in workplaces; Toxicokinetics of particles; Immuno-, neuro- and biochemical toxicology; Occupational Toxicology; Occupational hygiene, workplace monitoring and work health and safety; Ecotoxicology, environmental toxicology and contamination; Ecological and human health risk assessments; Risk management, perception and communication; Nanoproduct safety technology, nanorelease from nanoobject-containing products; Inhalation toxicology of nanomaterials; Standard nanomaterial development; International standards development for nanotechnology.
Facilities used for Nanosafety Research: Korea Research Institute of Standards and Science; Korea Conformity Laboratories; Korean Institute of Mechanics and Materials; Nano Fab Centers (many in Korea); Korea Institute of Toxicology; National Institute of Environmental Research; Occupational Safety and Health Research Institute, Korean OSHA; National Institute of Food and Drug Safety Evaluation.
Priority Nanomaterials for Nanosafety Research: Ag, CNTs, TiO_2, SiO_2, Au, ZnO
International Collaborations: Participation and Sponsoring in OECD WPMN Safety testing of nanomaterials (Leading and Sponsoring of 5 nanomaterials, i.e. Ag, MWCNTs, SiO_2, TiO_2, and Au); Exposure assessment and Exposure mitigation, Risk assessment, Sustainable use of Nanomaterials; ISO TC 229 (Nanotechnology), EU Nanocluster; Korea-US Nanoforum.
OECD Member: yes
ISO Member: yes
Nanosafety Experts: (being compiled)

Taiwan

The representative from Taiwan, Prof. Chuen-Jinn Tsai of National Chiao Tung University, joined the brief ANF business meeting at NanOEH6 on behalf of Prof. Gwo-Bin Vincent Lee, the coordinator of departmental policy and nanotechnology education of the National Program on Nano Technology (NPNT). In the meeting, Prof. Tsai talked about the nanotechnology-EHS achievements of various government and research institutions in Taiwan, including Taiwan IOSH, EPA, MOHW, NHRI, BSMI, ITRI, etc. He mentioned that next year is the last year of the second phase (2009-2014) of the NPNT, and the Nanotechnology-EHS related projects will be continued to ensure safe production and use of nanotechnology products. Since Taiwan has been promoting nanoMark products to booster the competitiveness of the nanotechnology industry, the product safety for the environment and users will further be studied and regulated to ensure sustainable development of nanotechnology industry in Taiwan. This is also the area that government institutions and scientists in Asian countries can collaborate, as pointed out by Prof. Tsai. Besides the ANF meeting, there were 16 professors and scientists from Taiwan attending the NanOEH6 to present their latest findings in Nano-EHS related projects and exchange ideas about future collaboration.

TAIWAN (excerpt of current ANF-EHS database information)
Nanosafety Point Of Contact: Prof. Gwo-Bin LEE (National Tsing Hua University; gwobin@pme.nthu.edu.tw)
Potential Funding Agencies for Research Linkages within Asia: Taiwan EPA, Taiwan NSC, Taiwan IOSH, ITRI, Taiwan National Program on Nano Technology.
Nanosafety Network/Initiative: Taiwan Nanotechnology EHS database.
Network Website: http://ehs.epa.gov.tw/Home/EN_F_Home_Index
Nanosafety Research Expertise: Synthesis and manufacture of engineered nanomaterials (ENMs); Characterisation of physico-chemical properties; Calibrated nanomaterials; Enviromental applications of ENMs; *In vivo*, *in vitro* tests; Standard test procedures for nanoMark products; Fire and hazard of ENMs; Samplers for ENMs; Best practice guidelines.
Facilities used for Nanosafety Research: IOSH, EAL of Taiwan EPA, NHRI, major universities, NML/CMS, and nanoMark accreditation laboratories are all equipped with a wide range of instruments for characterizing essential parameters of nanoparticles, including nanoparticle size, size distribution, charge, shape, chemical compositions, mass, surface area and particle number concentrations. NSRRC's Taiwan Photon Source (TPS) has a 3~3.3 GeV electron energy, 518 meter circumference, low-emittance synchrotron storage ring offering one of the world's brightest synchrotron X-ray sources.
Priority Nanomaterials for Nanosafety Research: Ag, ZnO, TiO_2, CNTs, SiO_2
International Collaborations: Taiwan NSC and various institutions are open to international collaborations with institutions in Asia and around the world.
OECD Member: no
ISO Member: no
Nanosafety Experts: (being compiled)



Thailand

Nanosafety and Ethics Strategic Plan of Thailand: initiatives and priorities

Thailand has recently introduced nanotechnology to the various industries and demonstrated the improved properties of nano-functions and added value to various products – especially in the industries that play a significant role in Thailand's economy, for example, textiles, food, and cosmetics. However, knowledge on the regulations of nanotechnology (particularly nanomaterials) regarding health and the environment, both directly and indirectly, are neglected and procedures are still uncertain. Currently, Thailand is continually developing institutions, both in the public and private sector, to exclusively monitor and control nanotechnology. Also, Thailand views the need to establish a Nanosafety and Ethics Strategic Plan. This plan shall work in parallel with nanotechnology development in preventing and preparing to minimize the potential risks of nanomaterials.

The Nanosafety and Ethics Strategic Plan originated by integrating various model schemes and strategic plans concerning national and international chemical safety measures, which also relates to the Thai governmental policies. It aims to manage unity and define the directions for nanotechnology precautions and ethics, in order for each institution to synergize and comply with the strategic plan and pursue the same direction.

The Strategic Plan demonstrates the directions, and guides Thailand to a *"Safe-Nano for Thailand's sustainable development"*. The three strategies are as follows:

- Establishing and implementing knowledge management in nanosafety and ethics and nanoproducts;
- Developing and reinforcing measures and monitoring mechanisms and enforcement;
- Strengthening and promoting public engagement activities.

On September 11, 2012, the cabinet approved the Nanosafety and Ethics Strategic Plan (2012-2016) and the National Nanotechnology Center (NANOTEC), and relevant agencies were afterwards entrusted with the implementation of this Strategic Plan.

Public hearing session on the Nanosafety and Ethics Strategic Plan in Bangkok, Thailand (photo by NANOTEC)

THAILAND (excerpt of current ANF-EHS database information)
Nanosafety Point Of Contact: Prof. Sirirurg SONGSIVILAI (NANOTEC; sirirurg@nanotec.or.th)
Potential Funding Agencies for Research Linkages within Asia: The Ministry of Science and Technology (MOST) of Thailand, National Science and Technology Development Agency (NSTDA), Thailand Research Fund (TRF).
Nanosafety Network/Initiative: The Nanosafety and Ethics Strategic Plan (2012-2016); National Nanotechnology Center (NANOTEC)
Network Website: www.nanotec.or.th/en/

Nanosafety Research Expertise:
Nano Safety and Risk Assessment Laboratory (SRA) of (NANOTEC) conducts research to address the possible adverse effects of nanomaterials on human health. We determine biological interaction, toxic mechanisms, biomarkers, and nano-drug interactions in various biological model systems. Nano Characterization Laboratory (NCL) of NANOTEC is dedicated to providing modern facilities for physicochemical characterization of manufactured nanoscale materials for toxicologic assessment. The laboratory aim is to be the focal point for measurement services and promote the safe use of nanotechnology by the industrial sector.

Facilities used for Nanosafety Research:
NANOTEC's Nano Safety and Risk Assessment Laboratory (SRA) has testing facilities that provide product safety testing to manufacturers. These tests are done based on product safety test standards: Skin irritation (OECD TG 439); Skin corrosion (OECD TG 431); Acute cytotoxicity (ISO 10993-5); Phototoxicity (OECD TG 432); Genotoxicity test by using comet assay and micronucleus assay. NANOTEC's Nano Characterization Laboratory (NCL) is equipped with various physicochemical characterization instruments, e.g. HR-TEM, FE-SEM, AFM, Confocal-RAMAN-AFM, XRD, FT-IR, HR-ICP-MS, GC-MS, DSC, TGA, BET, Dynamic Light Scattering (DLS). The Synchrotron Light Research Institute (SLRI) is a Public Organization under the supervision of the Ministry of Science and Technology of the Royal Thai Government. The SLRI has facilities to provide test services, such as SAXS, XAS, soft X-ray photoelectron spectroscopy and low-energy XAS.

Priority Nanomaterials for Nanosafety Research:
Ag, ZnO, TiO_2, SiO_2, Organic nanomaterials, CNTs

International Collaborations:
Several international collaborations, i.e.: (1) OECD Working Party on Manufactured Nanomaterials; (2) Strategic Approach to International Chemical Management (SAICM) about nanosafety and nano ethics in Thailand; and (3) ANF-EHS Program.

OECD Member: yes (O-member)

ISO Member: yes (O-member)

Nanosafety Experts: (details of expertise, email and web addresses are shown in ANF-EHS database at www.asia-anf.org/)
NANOTEC: Nano Safety and Risk Assessment Laboratory (SRA) – Dr. Rawiwan Maniratanachote, Dr. Sasitorn Aueviriyavit, Dr. Suwimon Boonrungsiman, Dr. Wittaya Pimtong;
Nano Characterization Laboratory (NCL) – Dr. Nuttapun Supaka, Dr. Phikunthong Kopermsub, Dr. Chaweewan Sapcharoenkun.

Current Asia Nano Safe Contact List (updates shown at www.asia-anf.org/)

ANF Member	Contact Person	Email Address
Australia	Assoc. Prof. Paul WRIGHT	paul.wright@rmit.edu.au
China	Prof. Qiangbin WANG	qbwang2008@sinano.ac.cn
India	Dr Shrikant JOSHI	svjoshi@arci.res.in; shrikantjosh@gmail.com
Indonesia	Dr Nurul Taufiqu ROCHMAN	ufiq2000@yahoo.com
Iran	Prof. Ali BEITOLLAHI	beitolla@iust.ac.ir
Korea	Prof. Il Je YU	u1670916@chol.com
Japan	Prof. Gaku ICHIHARA	gak@med.nagoya-u.ac.jp
	Dr Masahiro TAKEMURA	TAKEMURA.Masahiro@nims.go.jp
Malaysia	Dr Rezal Khairi AHMAD	rezal@mosti.gov.my
New Zealand	Prof. Simon BROWN	simon.brown@canterbury.ac.nz
Singapore	Prof. ONG Wei Yi	wei_yi_ong@nuhs.edu.sg
Taiwan	Prof. Gwo-Bin LEE	gwobin@pme.nthu.edu.tw
Thailand	Prof. Sirirurg SONGSIVILAI	sirirurg@nanotec.or.th
	Benyapa SUWAN	benyapa@nanotec.or.th
Vietnam	Prof. Nguyen Xuan PHUC	phucnx@ims.vast.ac.vn