Report

Technical Workshop for the Asia-Pacific Region
on Nanotechnology and Manufactured Nanomaterials:
Safety Issues

10 & 11 September 2015

Venue: Bangkok, Thailand

Organized by UNITAR and OECD
in cooperation with and hosted by the
National Nanotechnology Center NANOTEC in Thailand, with the support of the
Government of Switzerland

Background:

Nanotechnology has been recognized as an emerging policy issue since the 2nd International Conference of Chemical Management (ICCM2), Geneva, under the Strategic Approach to International Chemicals Management (SAICM). Also, nanomaterials have been used in various industries from textiles to cosmeceutical and the automotive industry for improving their properties such as water repellency, UV resistance, scratch resistance, and anti-microbials. Nonetheless, nanosafety issues in terms of risk assessment, safety regulation, standardization, and ecotoxicology research need to be strengthened. It is the case that some manufactured nanomaterials cannot decompose in a short period of time. If such nanomaterials diffuse into the soil or water, they may remain active for years. Additionally, some highly active substances such as titanium dioxide may affect life cycles of bacteria in the soil which might cause changes in the ecosystem. There is a chance that the leak of nanomaterials in the environment stays in the food chain and finally returns back to humans.

Thailand has recognized the importance of nanotechnology, with both potential benefits and risks. The National Nanotechnology Center (NANOTEC), National Science and Technology Development Agency, an autonomous organization under the Ministry of Science and Technology, established the National Nanotechnology Strategic Plan and the National Nanosafety & Ethics Strategic Plan, approved by the Cabinet in 2012.

During the past few years, NANOTEC, as a funding agency, has urged researchers to add the safety aspects to all nanomaterial R&D grant proposals. For example, nanoparticle-coated fabrics under development were subject to wash-water contamination tests. Nano-titanium dioxide (TiO2) coated fish tanks were tested for toxicity to fish. Skin creams containing titanium dioxide nanoparticles were also tested for skin penetration through a model (pig) skin. Ecotoxicity of nanosilver in waste water was also tested. More comprehensive nanomaterial safety data results have come from the Nano Safety and Risk Assessment Laboratory of NANOTEC, which specifically address two main areas regarding safety investigation of nanomaterials: 1) Human

health and 2) the Environment. As of September 2015, the effects of three nanomaterials, Ag, TiO2, and Au, had been investigated.

Also, with the support of UNITAR in the "Training and Capacity Building for the Development of the Nanosafety Pilot Project in Thailand (Phase I)" project in 2012, Thailand proposed to be a "Sub-regional Hub in Nanosafety and Nanotechnology" in the Association of Southeast Asian Nations (ASEAN) in order to strengthen our collaboration further among neighboring countries as well as developed and developing countries, in which risk management and public awareness will be promoted. Thailand is committed to the achievement of the 2020 goal of Sound Management of Chemicals and firmly believes that we can play an important role in moving forward the development of nanotechnology in the sub-region and at the global level.

As a result, Thailand proposed to collaborate with UNITAR to co-organize the Nanosafety Regional Workshop in the Asia Pacific region on 10-11 September, 2015 at the Convention Center, Thailand Science Park, Pathumthani (Bangkok).

Objective

1. to disseminate knowledge of nanotechnology and nanosafety for policy makers in the Asia-Pacific Region
2. to share the experiences and lessons-learned from experts in the region
3. to strengthen the Asia-Pacific network in nanotechnology
4. to initiate a nanosafety programme and integrate with the existing national programmes for each country.

BRIEF SUMMARY (Day 1)

The Technical Workshop for the Asia-Pacific Region on Nanotechnology and Manufactured Nanomaterials: Safety Issues was attended by seven Thai nanotechnology and standards' experts, along with 16 international experts from 11 nations. Also attending the workshop was a representative from the Swiss Embassy.

The first three speakers were from NANOTEC. Dr Sirasak Teparkum from NANOTEC gave a presentation on "Nanosafety in Thailand" in which he outlines the status of nanotechnology development in Thailand, the dilemma of nanotechnology development, the National Nanosafety & Ethics Strategic Plan (2012-2016), and the status of NanoQ labeling.

Next to give a presentation was Dr. Rawiwan Maniratanachote, also from NANOTEC, who gave a talk on Nanosafety and Risk Assessment. The presentation gave an overview of the various research activities conducted to address possible adverse effects of nanomaterials on human health. The talk also focused on biological interaction, toxic mechanisms, biomarkers, and nano-drug interactions in various biological model systems.

Dr. Annop Klamchuen from NANOTEC Nano Characterization Lab (NCL) gave a talk on Nanocharacterization and testing standards. According to Dr. Annop, the NCL provides over 6,000 testing services to both domestic and overseas clients each year.

Dr. Peter Kearns of OECD gave a presentation on “OECD Recommendation on the safety assessment of nanomaterials” in which he cited the five recommendations of the Chemicals Committee. The OECD recommends member countries apply existing national and international chemical safety frameworks to manage the risks associated with nanomaterials, while noting these frameworks may need to be adapted to reflect the specific and unusual properties of nanomaterials.

Next to give a presentation was Dr. Georg Karlaganis of UNITAR who gave presentations on the “Swiss Action Plan on Nanomaterials” and “UNECE GHS classification and labeling”. The Swiss Action Plan aims to create regulatory framework conditions for the responsible handling of synthetic nanoparticles. In the first phase, high value will be placed on the responsibility of industry. Self-supervision in the area of synthetic nanomaterials will be defined and voluntary measures by the industry will be supported. Only when the methodological foundations and well-grounded risk assessments of synthetic nanomaterials are available, can additional statutory framework conditions for the safe handling of synthetic nanomaterials be developed.

On UNECE GHS classification and labeling, Dr. Karlaganis commented that it was desirable to establish an internationally-harmonized approach to classification and labeling since there is extensive and increasing global trade in chemicals worldwide. The development of this programme is primarily to ensure safe use, transport and disposal of chemicals.

Dr. Vladimir Murashov, a Special Assistant on Nanotechnology to the Director of the National Institute for Occupational Safety and Health in the U.S. Department of Health and Human Services in Washington, D.C., gave a talk on “Occupational, consumer and environmental exposures of manufactured nanomaterials”. The research focuses on applications of nanotechnology in medicine such as cancer treatment drugs, imaging agents, and sensors that may serve to save people's lives and improve quality of life. Although only a limited number of nano-enabled medical applications are commercially available at this time, many are in the final stages of approval by regulatory agencies overseeing medical applications. Workers' exposure to nano-enabled medical applications in research and development laboratories and manufacturing facilities can already occur. It also reviews the information available on exposure to nano-enabled medical applications in occupational settings such as manufacturing and health care facilities. The report reviews monitoring exposure to conventional medical applications and it describes monitoring exposure to nanomaterials. The presentation finished by summarizing monitoring exposure to nano-enabled medical applications highlighting their unique aspects.

In addition, Dr. Murashov also presented on "Developing WHO Guidelines for Protecting Workers from Potential Risks of Manufactured Nanomaterials" where he indicated that the guidelines have incorporated elements of risk assessment and risk management and contextual issues. It also provided recommendations to improve occupational safety and protect the health of workers using nanomaterials in all countries and especially in low and middle-income countries.

NANOTEC lab visit

The participants took the opportunity to visit the following labs at NANOTEC:

- Nanomolecular Target Discovery Lab: which focus on the design and development of molecules for targeting purposes with main applications in infectious diseases, diabetes, and cancers.
- Nano Delivery Lab: emphasizes the use of nanotechnology for target delivery and controlled release of drugs, biopharmaceutical agents including bioactive compounds, in order to improve the effectiveness for prevention and treatment of human, animal and plant diseases.
- Nano-cosmeceutical Lab: focuses on applying nanotechnology in novel cosmeceutical products, especially from Thai medicinal herbs. The core strengths are on formulation, especially encapsulation in nanoparticles, nanoliposome, and nanoemulsion.
- Nano Safety and Risk Assessment Lab: conducts research to address possible adverse effects of nanomaterials on human health.
- Nano Characterization Lab: is dedicated to providing modern facilities for nano-scale analysis, measurement, and characterization of materials. The laboratory aim is to be the focal point for measurement services and promote the use of nanotechnology by the industrial sector

Brief Summary (Day 2)

The first speaker for day 2 was Dr. Karlaganis of UNITAR who reviewed the previous regional workshops (in the African, and Latin American and Caribbean regions).He presented the outcomes of the workshops which helped to share lessons with those participating in the Technical Workshop for the Asia-Pacific region. In addition, he also presented the proposed SAICM ICCM4 proposed resolution on nano[1].

The next three presentations focused on Case Studies from Thailand by Dr. Angkarn Wongdeethai of National Science Technology and Innovation Policy Office (STI) who gave a presentation on Thailand, by Prof. Gaku Ichihara of Tokyo University of Science in Japan who presented the Nanotech roadmap in Japan, and by Prof. Ali Beitollahi, Director of Nanostandardization Committee (INIC) in Iran who presented the Nanotech

[1] A resolution on nanotechnologies and manufactured nanomaterials was subsequently adopted at ICCM4: Meeting report will be available at:
http://www.saicm.org/index.php?option=com_content&view=article&id=525&Itemid=700

roadmap in Iran, including Nanosafety network and nano standardization.A common thinking expressed by the three presenters indicated that nanoscience and nanotechnology are giving new ways of thinking about development, and can play an important role in helping developing countries move towards sustainability. However, it is important to establish collaboration between nations in developing an ethical roadmap on how the issues raised by this technology should be handled. Nations that are considered more experienced and have put in place infrastructures to handle safety aspects should be open to playing the role of mentor.

One of the highlights of the workshop was the short presentations from nine country representatives:

- "UNITAR pilot project: Background, current works and future plan" by Mrs. NGUYEN Hoang Anh, Deputy Director Pollution Control Department (PCD), Vietnam Environment Administration (VEA).

  The presenter indicated that the project focused on awareness workshop which took place in March 2014, regulations on nanotechnology and nanosafety research and application of nanotechnology, awareness on nanosafety and developing work plans for the future.

- "Silver Nanoparticle and Ecotoxicology Research: Some Uncertainties" by Dr. Mila Tejamaya, Lecturer at Occupational Health and Safety Department, Faculty of Public Health, University of Indonesia

  The presenter indicated that synthesizing silver nanoparticles that are both uniform and stable and to be able to control their size distribution is a difficult task.

  Once released into the environment, the mobility, bioavailability, and toxicity of AgNPs in any ecosystem are dominated by colloidal stability. There have been studies on the stability or the aggregation of various NPs under a range of environmental conditions, but there is little information on fully characterised AgNPs in media used in (eco) toxicity studies.

- "Neurobehavioral Effect of Nanosilver in Adult Male Offspring of Adult Rats" by Dr. Mahmoud Ghazi-Khansari, Dept. of Pharmacology, School of Medicine, Tehran University of Medical Sciences

  The presenter informed that prenatal exposure to AgNPs can induce depression-like behaviors in the offspring and ascorbic acid cannot reverse its toxicity.

  Toxicity of AgNPs is size dependent.

There is a warning related to the exposure of pregnant women to AgNPs.

- "Nanotechnology & OHS in Indonesia" by Ms. Lelitasari Danukusumo, 4Life OHS Services

  The presenter, from the private sector, talked about the work of various nanotechnology research centers including 4 Life OHS Services and the projects that are going on in each of the centers.

  The presentation also stressed the need for nanotechnology to become a national priority in Indonesia given the fact that the country is importing goods which do have nanotechnology incorporated in the production. In addition, it will help leapfrog R&D activities.

- "Safety/ Toxicity testing and Knowledge dissemination" by Dr. Debapratim Kar Chowdhuri, Chief Scientist & Professor, AcSIR CSIR-Indian Institute of Toxicology Research, Lucknow, Uttar Pradesh, India

  The presenter informed that there are 14 laboratories that are working with CSIR across India. In addition, he also presented the various activities that have taken place and which are in the pipeline such as workshops, conferences, lectures in academic setting, and journal publications.

- "Civil Society Organizations' Perspectives on Nano Safety Issues" by Yuyun Ismawati, BaliFokus Foundation, Indonesia Toxics-Free Network

  The speaker talked about the various international organizations that are working on nano safety issues such as SAICM and BaliFokus Foundation including others working on behalf of workers and consumers.

  Areas of discussion were mostly on chemicals in products and issues related to chemical management.

- "Pacific Perspectives under SAICM on Safety of Manufactured Nanomaterials" by Ms Imogen INGRAM from Island Sustainability Alliance CIS Inc. ("ISACI")

  The presenter informed about the IPEN Nano Working Group and the importance of SAICM forum to the region.

  The presentation also touched on the public expectation for use of nanotechnology and reality check.

- "Carbon Dioxide Reduction with Hydrogen Using Photonanocatalyst" by Nor Aishah Saidina Amin, Chemical Reaction Engineering Group (CREG),Faculty of Chemical Engineering, Universiti Teknologi Malaysia

  The talk pertains to the enhanced efficiency of monolith photoreactor for CO2 reduction to fuels, efficient CO2 reduction with H2 to CO and HCs over Au/TiO2.Yield of CO production over Au/TiO2 increased to 318 times higher than TiO2
  Selectivity of CO production reached above 99% by Au, enhanced Au/TiO2 activity was due to plasmonic effect, efficient trapping of electrons and inhibited charges recombination by Au-metal, and tests revealed prolonged stability of Au/TiO2 in cyclic runs.

Meeting Outcome:

The final agenda item was to identify needs and priorities in the Asia-Pacific region, done in a workshop setting. The group assigned a moderator (representative from Iran) and a note taker (representative from Malaysia) who provided the summary of the meeting outcome. The final outcome of this workshop was determined by consensus as following:

- to establish a strong network/communication hub to continue collaboration with the nanosafety working group under the umbrella of Asia Nano Forum;
- to raise the awareness of nanosafety by organizing training workshops;
- to develop the standardization / harmonization mark in the region; such as NanoQ in Thailand and NanoMark in Taiwan.
- to encourage the strong commitment from local governments.

The working group agreed that Thailand will give a report at a side event during ICCM4 on 28 September 2015 in Geneva[2]. Regarding the outcome of this workshop, Thailand proposed to organize the follow up Asia-Pacific regional workshop at the International Conference "NanoThailand 2016" in November 2016.

[2] Side event summary available at: http://www.unitar.org/cwm/iccm4-nano-side-event-%E2%80%93-unitar-switzerland-oecd

Participant List

First name	Last name	Country
Hoanganh	Nguyen	Vietnam
Debapratim	Karchowdhuri	India
Saidinaamin	Noraishahbinti	Malaysia
Binmasrom	Abdulkadir	Malaysia
Mahmoud	Ghazikhansari	Iran
Ali	Beitollahi	Iran
Kalumarakkala	Desilva	Sri Lanka
Liyanage	Athapaththuhewawasam	Sri Lanka
Yuyunyunia	Ismawati	Indonesia
Milatejamaya	Mulyono	Indonesia
Lelitasarisutadji	Danukusumo	Indonesia
Imogenpua	Ingram	Cook Island
Vladimir	Murashov	USA (UNITAR)
Gaku	Ichihara	Japan
Peter	Kearns	UK (OECD)
Georg	Karlaganis	UNITAR
Aurus	Kongphanich	FDA (Thailand)
	Pumcam	FDA (Thailand)
Pitchaya	Saksripanit	FDA (Thailand)
Angkarn	Wongdeethai	National Science Technology and Innovation Policy Office (STI)
Viktor	Vavricka	Swiss Embassy, Bangkok
Sami	Manai	Swiss Embassy, Bangkok
Sirirurg	Songsivilai	NANOTEC
Sirasak	Teparkum	NANOTEC
Rawiwan	Maniratanachot	NANOTEC
Annop	Klamchuen	NANOTEC

Photos