Nanotechnology: Risk Assessment & Safety Compliance in THAILAND

Sirasak Teparkum, Ph.D
Deputy Exec. Director
National Nanotechnology Center (NANOTEC), Thailand
S&T Community in TSP

- Residential Area
- Pilot Plants
- Innovation Cluster 2 (Under Construction)
- Convention Center
- Garden of Innovation
- Innovation Cluster 1 (Multi-Tenants Unit)
- FUTURE DEVELOPMENT

Logos of organisations: NANOTEC, MTEC, BIOTEC, NECTEC, TMC, and NSTDA.
NANOTEC ROLES

POLICY DEVELOPMENT
National Nanotech Policy
Nanotechnology Roadmap
NanoSafety Plan

RESEARCH & DEVELOPMENT
In-house Labs (12 R&D teams)
CoE (8 universities)
Funding

TECHNOLOGY TRANSFER
Contract research
Joint research
Consultation / Training

NATIONAL CENTRAL LAB
Synchrotron beamline
Computation Consortium
Scholarship Students
Thailand Major S&T Strategic Plan

- National S&T Plan 2004-2013
  - NSTDA Master Plan 2007-2011
  - NSTDA Master Plan 2012-2016
  - NANOTEC Policy 2007-2013
  - NANOTEC Policy 2014-2021
  - NANOTEC Master Plan 2007-2011
  - NANOTEC Master Plan 2011-2021

- National Science, Technology and Innovation Policy 2012-2021
- 8th National Research Plan 2012-2016
- National NanoSafety Plan 2012-2016
Commercialized Nano-products

R&D --- Characterization
PRODUCTION --- Inspection / Validation / Monitoring

COMMERCIALIZED PRODUCTS
- REAL or FAKE ?
- REAL with QUALITY ?
- REAL with SAFETY ?

PHYSICO-CHEMICAL PROPERTIES

TOXICOLOGY
Social Visibility on Nanotechnology

- Too many Experts
- Excited VCs
- Scramble to own Nano-business
- Nobody making any money

Let’s Do Clean Nanotechnology

Visibility

- New Industrial Revolution
  Invest Now!
- NNI Launch in 2000
KNOWLEDGE MANAGEMENT

S1: KNOWLEDGE MANAGEMENT

S2: REINFORCEMENT & ENFORCEMENT

S3: PUBLIC ENGAGEMENT

2012 - 2016

NATIONAL NANOSAFETY PLAN

SAFE-NANO FOR THAILAND’S SUSTAINABLE DEVELOPMENT

KPI 1
EFFECTIVE MANAGEMENT SYSTEM

KPI 2
PRODUCT LABELING

KPI 3
PUBLIC KNOWLEDGE & AWARENESS

STRATEGY

ENGINEERING

ECONOMY & FINANCE

EMPOWERMENT

EDUCATION

ENFORCEMENT

GOVERNMENT MINISTRIES & ASSOCIATIONS
STRATEGY 1: ESTABLISHMENT OF KNOWLEDGE MANAGEMENT


NANOSAFETY DATABASES

KNOWLEDGE MANAGEMENT & IMPLEMENTATION

INFORMATION CENTER OF THAILAND (NICI)
KNOWNANO.ORG

THAILAND NANOSAFETY DATABASE

SAFETY MANUAL FOR NANOMATERIAL BASED RESEARCH WORK

SAFETY MANUAL FOR NANOMATERIAL BASED INDUSTRY
## STRATEGY 2: MEASURES REINFORCEMENT & ENFORCEMENT

<table>
<thead>
<tr>
<th>Year</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>Having agencies and warning systems for product nanosafety</td>
</tr>
<tr>
<td>2013</td>
<td>Testing lab available for nanoproducts</td>
</tr>
<tr>
<td>2014</td>
<td>Labeling with scientific evidence</td>
</tr>
<tr>
<td>2015</td>
<td>Having nanosafety and ethics measures</td>
</tr>
<tr>
<td>2016</td>
<td>Having mechanisms to support/monitor/enforce the measures</td>
</tr>
<tr>
<td></td>
<td>Having controls on products advertisement</td>
</tr>
</tbody>
</table>

**INSTRUMENTS: PHYSICAL & PHYSICAL IMAGING**

- **Nano Q**
  - Nano Q is a certified quality mark for nano products which are certified by Nanotechnology Association of Thailand.
  - Motivation to have Nano Q:
    - Increase Public Trust: Facilitate healthy development of nanotechnology
    - Protect Consumer: Avoid waste money
    - Protect Good Companies: Eliminate unfair competition
    - Facilitate Trade: Stimulate economic growth
  - Structure of Nano Q:
    - Simple cycle
    - Quality assurance
    - Research and development
    - Quality control
  - Benefits of Nano Q:
    - Quality assurance
    - Research and development
    - Quality control

**Instruments:**
- **HR-TEM**
- **AFM**
- **SEM**
- **AFM / Raman Spectrometer**

**Logos:**
- TISi
- Thai FDA
- NIMT
STRATEGY 3:
PUBLIC ENGAGEMENT

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC &amp; CONSUMER NETWORK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACCESSIBILITY TO INFORMATION FROM PUBLIC MATERIALS FOR EDUCATION SYSTEM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

KPI

ACTIVITY

BOOK    MODEL    & WORKSHOP
CURRENT STATUS

MATERIAL METHOD

INSTRUMENTS: PHYSICAL & PHYSICAL IMAGING
- HR-TEM
- AFM
- SEM-EDX/WDX
- AFM/Raman Spectrometer

INSTRUMENTS
- DLS
- FTIR
- GC-HPLC-MS
- XRD
- Contact Angle
- DSC-TGA
NANOTEC Testing Service Lab Equipment

Scanning Electron Microscope

Scanning Tunneling Microscope

High Pressure Homogenizer

Transmission Electron Microscope

Atomic Force Microscope

Antibacterial test

Nanosizer
Nano-measurement & Nano-characterization Service Lab

• Capabilities
  – Physical & chemical testing: particle size and nanoparticle distribution analysis (nanosizer/ Dynamic light scattering)
  – Structural surface analysis (AFM/STM/ E-SEM)
  – Biological testing: MTT toxicity assay, anti-bacterial testing (AATCC standard)
  – Nanoparticle preparations in powder and emulsion form.
• **Nano Q** is a certified mark for nano products which are certified by Nanotechnology Association of Thailand.

• **Motivation to Have Nano Q**
  - Increase Public Trust: Facilitate healthy development of nanotechnology
  - Protect Consumer: Avoid waste money
  - Protect Good Companies: Eliminate unfair competitions between good and bad products
  - Facilitate Trade: Stimulate economic growth
Structure of Nano Q

Executive Committee of Nanotechnology Association of Thailand

Nano Q Committee

Advisor

Technical Subcommittee

Legal Subcommittee

Public Relations Subcommittee
Nano-EHS activities in Thailand

NANOTECHNOLOGY CENTER OF EXCELLENCE (B CoE)

interlab. comparison

NANOMETROLOGY

TESTING LAB

NIMT

STANDARDIZATION

CERTIFICATION / LABELING

REACH nanomaterials
ICCR cosmetic directive

NanoQ
Textile / Paints/Coating / Plastics etc.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. Department of Commerce

UNITED NATIONS INSTITUTE FOR TRAINING AND RESEARCH

ANF
ASIA NANO FORUM

ISO

REGULATION

NanoQ
Textile / Paints/Coating / Plastics etc.

Nano-Q Textile / Paints/Coating / Plastics etc.

Nano-EHS activities in Thailand

NANOMETROLOGY
Thank you for your attentions