Regulation of nanotechnologies

Guillermo Foladori
Autonomous University of Zacatecas, Mexico
Latin American Nanotechnology and Society Network –ReLANS-
www.relans.org

NANOFORUM Colombia 2015
Cartagena 4-6 agosto 2015

Reasons for regulating

- **Risks to health & environment**
- **Commercial homogenization**
- Economic disruption (employment / social division of work) and/or areas to incentivize
- Individual freedom, ethical issues (transparency, producer responsibility, military applications, etc.)

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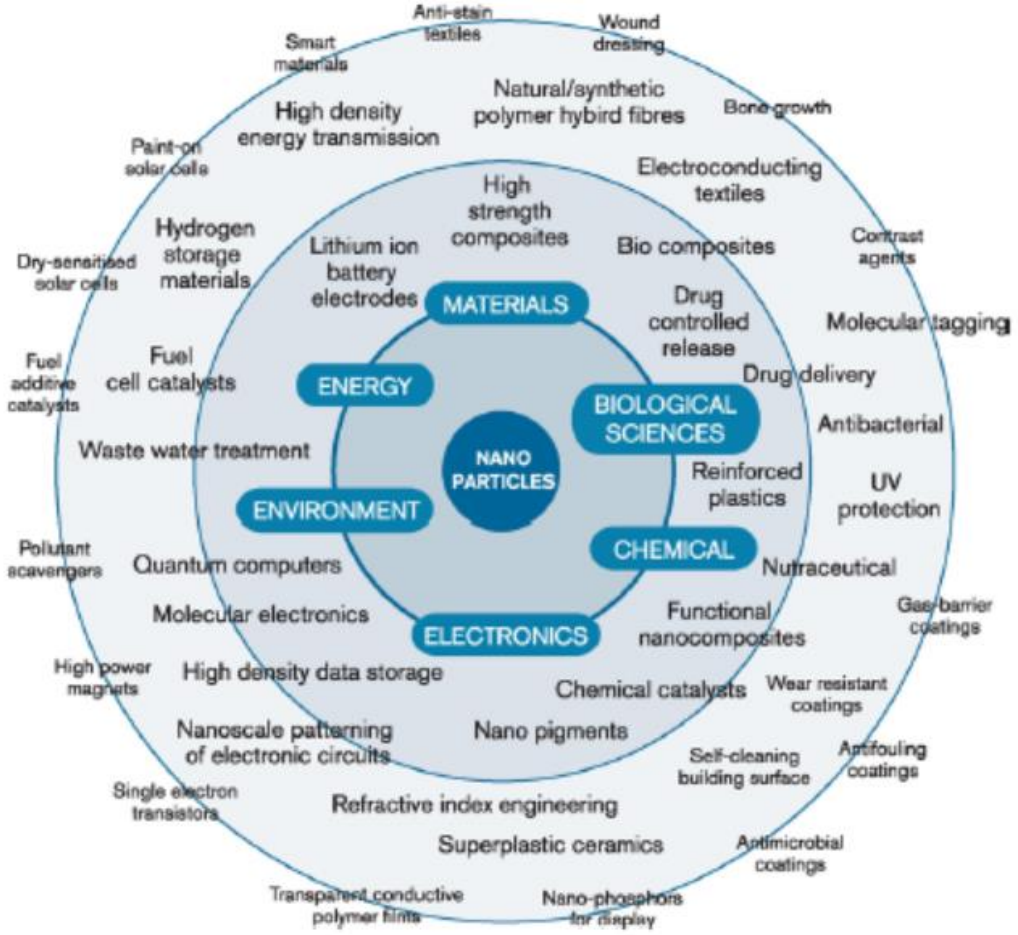
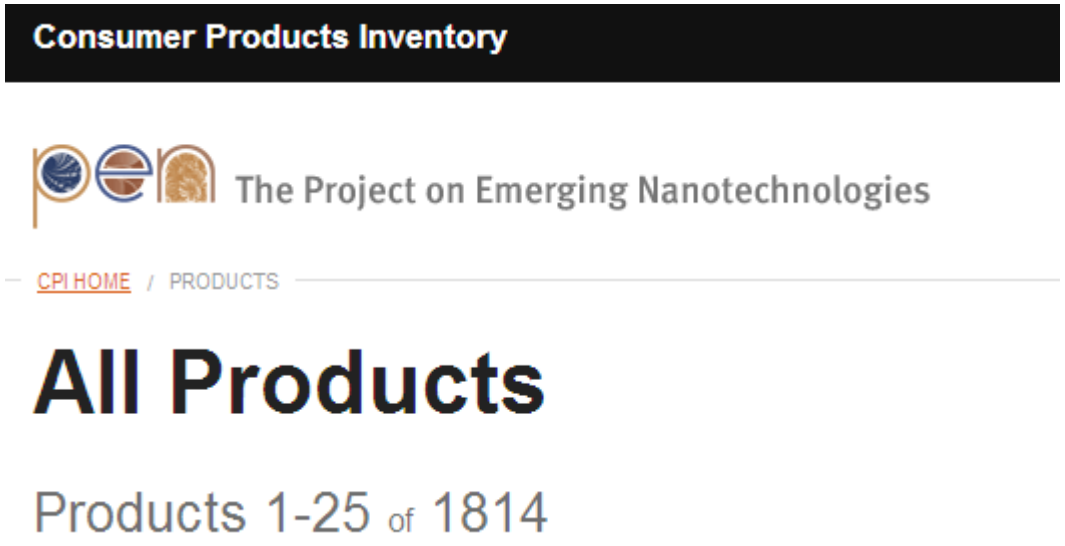
Nanotechnologies: general purpose technologies



Not all sectors have equal capacity on occupational safety, neither consumers

Tsuzuki, T. (2009). Commercial scale production of inorganic nanoparticles. *International Journal of Nanotechnology*, *6*(5), 567–578. doi:10.1504/IJNT.2009.024647

Nanomaterials enter marketplace without regulation



WWICS. (2015). *A nanotechnology consumer products inventory project on emerging nanotechnologies*. Washington DC: WWICS (Woodrow Wilson International Centre for Scholars). Retrieved from http://www.nanotechproject.org/inventories/consumer/
Search: 07/02/2015

Great variety of nano raw material

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Nanotechnology Databases

Comprehensive databases for nanomaterials, events, products, companies, research labs, degree programs and publications

Search

Nanomaterials Database

The unique Nanowerk *Nanomaterial Database*™ is a powerful, free tool for the nanotechnology community to research nanomaterials such as carbon nanotubes, nanoparticles, graphene or quantum dots from more than 200 suppliers worldwide. Currently, our database contains over 3,000 nanomaterials.

Main nano raw materials (OCDE)

- Fullerenes (C60)
- Single-walled carbon nanotubes (SWCNTs)
- Multi-walled carbon nanotubes (MWCNTs)
- Silver nanoparticles
- Iron nanoparticles
- Titanium dioxide
- Aluminium oxide
- Cerium oxide
- Zinc oxide
- Silicon dioxide
- Dendrimers
- Nanoclays
- Gold nanoparticles

Contents

Chemicals: World pandemic OMS 2004

- 2004: almost 5 million death (8.3% of world total). 86 million sick / disability
- 248 000 chemical substances in the market. 700 new chemicals enter the USA market per year.
- 181 tested by public entities for health & environmental effects
- Only 7% out of 3000 chemicals produced in high quantities with data claimed by OCDE

UNEP (2012) *Global Chemicals Outlook. Synthesis Report for Decision–Makers, 2012, www.*unep.org/pdf/gco _Synthesis%20Report_cbdtie_unep_September5_ 2012. pdf›.

De los 5.7 millones de toneladas métricas de contaminantes liberados o desechados en Norteamérica durante 2006, 1.8 millones de toneladas métricas eran sustancias químicas persistentes, bioacumulativas o tóxicas, 970.000 toneladas métricas eran sustancias cancerígenas conocidas o sospechosas de serlo y 857.000 toneladas métricas eran sustancias químicas tóxicas para la reproducción y el desarrollo.

PNUMA. (2012). Global Chemicals Outlook. Pnuma. Retrieved from http://www.unep.org/chemicalsandwaste/Portals/9/Mainstreaming/GCO/Rapport%20Synthese%20Espanol.pdf

Ex. of toxic chemicals in articles

Químico	Producto	Toxicidad
Perfluorinated compounds (PFCs) 1950-2000 (US EU) then China…	Water repellent and non wrinkle Textiles (fire-fighting foams, hydraulic fluids, photo images, semiconductors for personal computers, carpet spot removers, mining and oil well surfactants, and other specialized chemical formulations. They are also used as water, oil, soil and grease repellents on carpets, fabric, upholstery, and food packaging, among other)	Persistent & bio-cumulative. Cancer
Lead	Toys and jewelry (radiation and sound shields, batteries, wheel weights, fishing sinkers, ammunition, and other products. Lead and lead compounds are also used in making paints and pigments, and heat stabilizers for polyvinyl chloride (PVC) plastics)	Neurotoxic. Kidney damage, blood pressure and reproductive effects. Cancerígeno
Nonylphenol ethoxylates	Textiles (surfactants)	Persistent & toxic for aquatic org. + endocrine disruptor
Lead, cadmio, mercury, berilio antimonio, fire retardants of bromo, organo fluorates, PVC	Computers and electronics	Several toxicities
Asbesto, fire retardants	Construction	Several toxicities

Voluntary agreements on chemical substances

Año	Nombre	Tema	Nota sobre Nanomateriales
1987	Montreal Protocol	Ozone layer	
1989	Basel	Transboundary movement of hazard waste	Incipient study of nanomaterials in waste
1998	Rotterdam	Previous notification to export of hazardous substances	
2001	Stockholm	POPs Persistent organic pollutants	Most of nanomaterials are not organic
2012	SAICM/ICCM	nanomaterials	Only agreement with recommendation on nanomaterials
2013	Miramata	Mercury	

Contents

Risks of nanomaterials

- They develop different physic and chemical and toxicological properties than in bulk
- Living organisms do not have the historical experience of centuries of evolution to be immune
- They enter the marketplace with no specific toxicological analyze
- There is evidence of toxicity on several nanomaterials. Hundreds of scientific articles on this (6000 in the *Virtual Journal of Nanotechnology, Environment, Health and Safety*

Why nanomaterials enter the market without regulation?

- **Chemical regulation is new (70s)**. By that time thousands of chemicals already in the market. (Reach existent chemicals vs. New chemicals).
- **Toxicological analysis expensive and slow**.
- **Workers pay social costs, consumers; and society through taxes.**
- **Chemical industry.** Lobby and litigation to delay and block regulation

Contents

Nanotech context is different from ICTs and Biotech. 1980s & 1990s vs. 2000

- Greater corporative wealth concentration
- Greater corporative control of value chains
- Greater requirements for initial investment
- Greater difficulty for Small & Medium enterprises to survive ("Strategic investor" & patents bum)

Nano-raw material. Huge corporative concentration

10 companies produce more than 80% of CNT

- Cnano Technologies
- Showa Denko
- Nanocyl
- Yunnan Great Group
- Nano Carbon Tech
- Hyperion Catalysis
- Frontier Carbon Corp
- Arkema
- Shenzen Nano-Tech
- Iljin Nanotech

Contents

Tendency to private litigation and regulation

A) Standard (vocabulary and definitions, toxicity, safe protocols, etc.)

B) Litigation: international and national

A) Standard

Regulated by private international agreements

Ex: ISO standard

WTO requires countries to base their regulation on international standard. ISO is the only recognized by the WTO

International Organization for Standardization (ISO). **Technical Committee on Nanotechnology (ISO/TC 229)**

B) Litigation: Trade treaties need to homogenize regulation

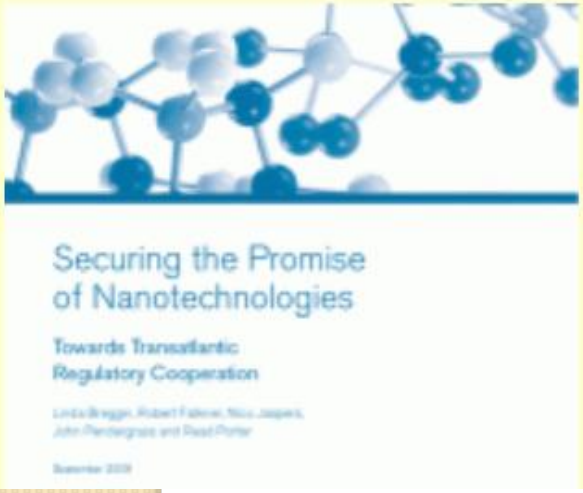
- Level up
- Level down

RESEARCH REPORTS

Securing the Promise of Nanotechnologies Towards Transatlantic Regulatory Cooperation

Authors: Linda Breggin, Robert Falkner, Nico Jaspers, John Pendergrass and Read Porter

Date Released: September 2009



"In no area has this been a greater problem than in chemicals. In this sector, the U.S. and EU have fundamentally different regulations on issues such as genetically modified organisms (GMOs), hormones, and the registration and restriction of chemical substances"

Ahearn, R. J. (2009). Transatlantic Regulatory Cooperation: Background and Analysis. Retrieved September 7, 2014, from http://www.europarl.europa.eu/meetdocs/2009_2014/documents/d-us/dv/d-us_transatlantic_regulatory/d-us_transatlantic_regulatory_4.pdf

B) Litigation: Investor-State Dispute Settlement (ISDS)

Guarantee foreign investors private arbitrage when litigation with States. States internal law does not run for foreign investors.

The Investor-State Dispute Settlement (ISDS)

OECD: 57 ISDS cases filed against governments in 2013

Year	Country	Corp.	Topic
2012	Canada	Lone Pine	Quebec ban on fracking
2012	Indonesia	Churchill Mining	Revoked concession
2012	Ecuador	Occidental Petroleum	Violation of contract 1.8 bn
2012	Uganda	Tullow Oil	VAT on goods
2012	Egypt	Veolia group	Salary increment
2012	Germany	Vattenfall	Ban on nuclear plants
2011	Australia	Philip Morris	Plain packaging
2010	Uruguay	Philip Morris	Graphic health warning
2010	Ecuador	Burlington Resources	Indigenous revolt
2009	Germany	Vattenfall	Ban on fire coal plants

Ottawa sued over Quebec fracking ban

Company's suit based on NAFTA provisions

The Canadian Press Posted: Nov 23, 2012 11:05 AM ET | Last Updated: Nov 23, 2012 12:23 PM ET

Hydraulic fracturing has come into widespread use in North America. (Associated Press)

An American company intends to sue the Canadian government for more than $250 million over Quebec's controversial moratorium on hydraulic fracturing or fracking.

ISDS

- Favors private arbitrage over State regulation. (Implicit: National courts do not offer justice for investors). Different conflict resolution for national and international investors
- Property rights over human rights (e.g. labor rights)
- UNCTAD. In 2012 514 ISDS. 70% won by transnational corporations
- 64% of ISDS initiated by investors from EEUU and EU.
- The highest compensation from a ISDS: 1770 US$ to Occidental (Oil) over Ecuador
- In 2011, 3 law firms run 130 ISDS
- Medium costs for arbitrage 8 million US$

Patents

OMPI

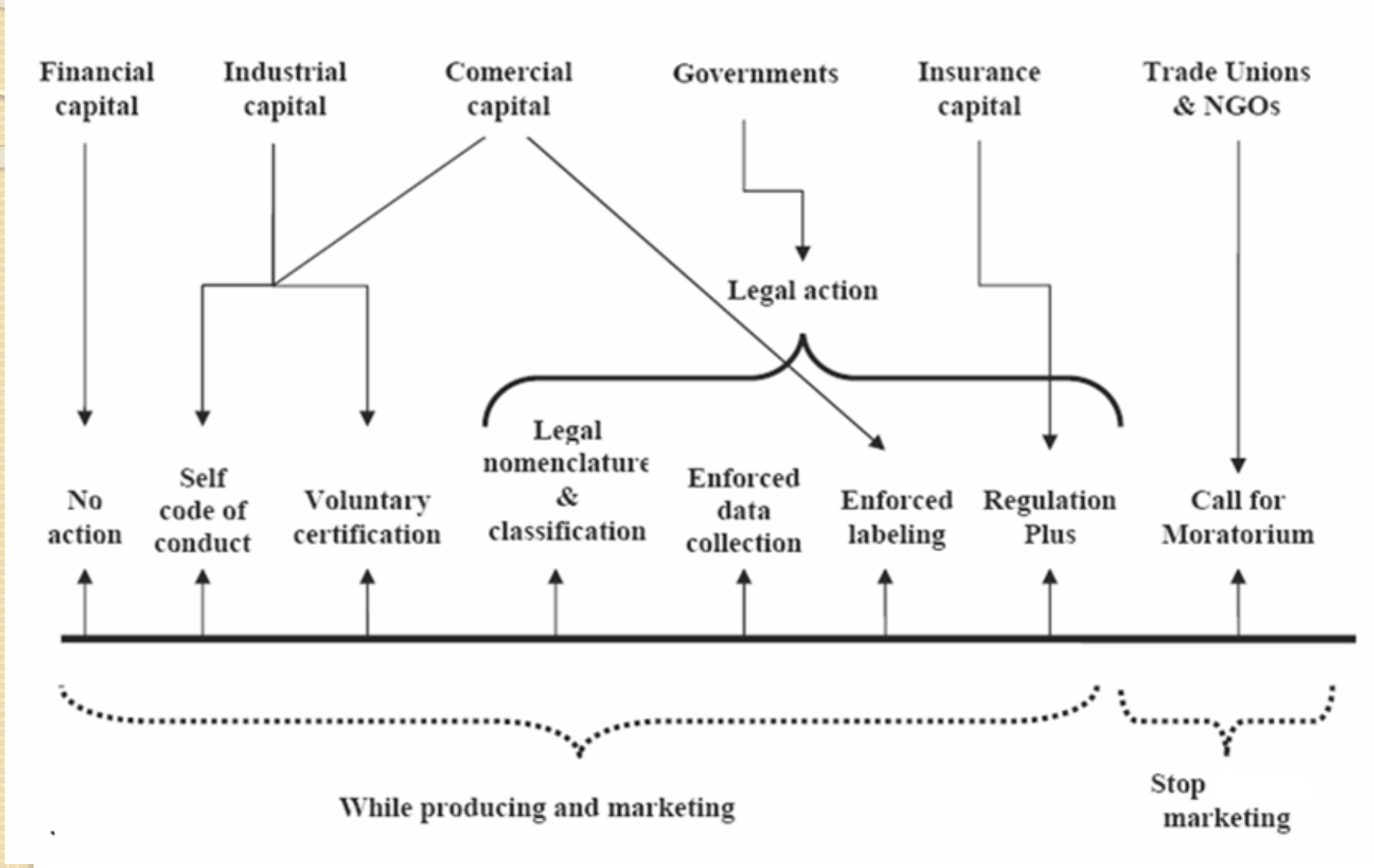
- 1990: 20 000
- 2000: 90 000
- 2006: 140 000

American Intellectual Property Law Association: The cost of litigate a patent is around 2.6 million U$S (increased of 70% from 2001).

Confronting forces

- **Two paralel movements**
  - Ministries of Commerce, Economy etc.
  - Ministries of Health, Environment, Labor etc.

Who is interested in regulating nanotechnologies?



Foladori, G. (2009). La gobernanza de las nanotecnologías. *Sociológica*, 24-71, 125-153. ISSN: 0187-0173

Questions & difficulties for regulating nanotechnologies

- Is regulation needed?
- Regulate only new or also existent nanomaterials?
- % of nanoparticles?
- Definition by size, size & new function, other?
- 100 nm is the limit size?
- Regulate by size, mass, shape?
- One criteria for different nanomaterials?
- Only intentional or also incidental & natural nanoparticles?

- Existent toxicological protocols or new and specific?
- Should products without toxicological data enter the market?
- How to regulate active nanomaterials?
- 1 ton/ year; 100 gr / year ?
- What to do with products that are simultaneously biocides, pesticides, food package? (e.g. silver nanoparticles)

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I. Context

1. Nanotechnologies: general purpose technologies
2. Chemicals: world pandemia
3. Risks of nanomaterials
4. Commercial context

II. Regulation

1. Generalities
2. World level
3. Latin America

Landmark in nano regulation

Year	EU & Europe	USA
2004		US Patent Class 977
2008		EPA SNURs
2009	Cosmetics	
2011		Canada & USA Council
2011		EPA SNURs MWCNT
2011		Memo Dept Commerce
2011	Food	
2012	Biocidals	
2013	France	
2013	Norway	
2014	Belgium	
2014	Denmark	
2015	Sweden	
2015	Canada	

Main positions on the regulation of nanomaterials

Topic	USA	EU
Precautionary principle	No. Politic of Known Risks	Accepted
Hazard vs. risk	Manage risk	Address hazard before risk
Manage risk	Economic benefit > risk; End of Pipe	Includes ESLI
Producer responsibility	Presumption of safe	No data no market
Property rights	Priority. No registration, no labelling	Basic civil rights first

Current EU regulation

Year	Item	Evaluation & Authorization	Registration	Labelling
2011 (EU) No 1169/2011	Food additives & materials in contact	Required		Labelling
2012	Biocidal	Required		Hazard classification & labelling
2009 (EC) No 1223/2009	Cosmetics		Required ingredients and safety data	Labelling
	Chemicals		Required for new substances	Hazard classification & labelling

France

Mandatory registration of industries working with nanotechnology

- 2013 on -

República Francesa (2012 feb., 18). Chapitre III : Prévention des risques pour la santé et l'environnement résultant de l'exposition aux substances à l'état nanoparticulaire. *Code de l'environnement* Article L523-1, 2, 3, 4, 5. http://www.legifrance.gouv.fr/affichCode.do;jsessionid=4BA24E14E56D824D6E9FB410958E690E.tpdjo14v_3?idSectionTA=LEGISCTA000022494883&cidTexte=LEGITEXT000006074220&dateTexte=20120220

Norway


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362
Norwegian Government Agency makes Submission of Information on Nanoscale Substances mandatory
Posted on 09 Jan 2013
The Norwegian Climate and Pollution Agency (Klif) has changed the information requirements for chemicals registered with the Norwegian Product Register. It states that 'information about substances in nano form must be given'. This news comes as the agency sends out letters requesting registrants to do their annual update of chemical information.
The register this year contains a NANO box, which 'should be marked if the chemical contains nanomaterials'. Respondents will also need to 'identify which constituent [it is] that is in the nanoform'. Furthermore during the course of 2013 registrants 'will have to update the composition for all your mandatorily declared chemicals that contain substances in nanoform'.
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Subscribe to our Monitoring Services >
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Voice of Nanotech
13 Jul

Denmark


virk
Indberet
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Forside ›
Nanoproduktregister
Danske virksomheder kan her indberette informationer om nanoprodukter som de er forpligtet til at registrere jf. Bekendtgørelse nr. 644 af 13. juni 2014.

Belgium


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by RESIDENCE PALACE
INTERNATIONAL PRESS CENTER
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Plan du site
Centre de presse
Communiqués de presse
Multimédia
Facilités presse
Contacts presse
Evénements
Calendrier
Appui logistique
Salles de conférence
Organiser un événement
Résidence Palace
Histoire
Bâtiment
Café-restaurant
Accès
Vous vous trouvez ici : Accueil › Communiqués de presse › La Belgique met en place un registre des nanomatériaux
Voir ce communiqué en NL FR
La Belgique met en place un registre des nanomatériaux
Par Sarah Delafortrie, Christophe Springael
Publié le 07/02/2014
Appartient au Conseil des ministres du 7 février 2014
Sur proposition de la ministre des Affaires sociales et de la Santé publique Laurette Onkelinx, le Conseil des ministres a marqué son accord sur l'arrêté royal relatif à la mise sur le marché des substances manufacturées à l'état nanoparticulaire.

France, Denmark, Belgium

Criteria	EU (Reach)	France 2013	Denmark 2014	Belgium 2016 /17
Reg.		Ex post market	Ex post market	Ex ante market
Nanomat.		Intentionally	Intentionally + Natural + Incidental	Intentionally
Prod /import		Yes	If for B2C (no B2B)	Yes (except when in articles)
Threshold	1 Ton	100 gr/year	No	100 gr/year
Penalty		Fine	To determine	Fine & prison
Exception		Defense		
Other				Inf. to Health & Safety worker´s committee

Based on: Squirepattonboggs.com. (15 Feb). Growing issues in a miniature world: nanomaterials registers in the European Union. Retrieved from http://www.squirepattonboggs.com/news; Bochon, A. (2015, March 16). Do you need to register your nanomaterials in the European Union? *My Chemical Monitoring*. Retrieved from http://www.mychemicalmonitoring.eu/news/73403e63-3194-4295-96a0-740c8b9bbee8/Do_you_need_to_register_your_nanomaterials_in_the_European_Union
and personal review of docs.

Sweden

Sweden to develop a Nanomaterial Registry

Posted on 22 May 2015

The Swedish Chemicals Agency (KEMI) has been tasked with the designing of a national nanomaterial register in Sweden. Upon the request of the Swedish Ministry of the Environment (Miljödepartementet) [in Swedish], KEMI is drafting a proposal for a register and conducting an impact assessment. Consultations will be run with Agencies and stakeholders. KEMI intends to finalise this process by 1 December 2015.

In 2013, the Swedish authorities had already advocated the creation of register in its *National Action Plan for the safe use and handling of Nanomaterials.*

Germany, on the way …

ENDS Europe

Europe's environmental news and information service

SEARCH

20 November 2012

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NEWS

Print Version

German minister backs register for nano-products

ENDS Europe

Thursday 3 February 2011

An advisory body to the German government has issued preliminary guidelines for assessing nano-products' risks and benefits. It is divided on the need for a register of such products but Norbert Roettgen backed the idea.

The environment minister was referring to the need for a registry at EU level, an idea championed by Belgium during its presidency of the union in the second half of 2010. Germany-based Oeko Institute welcomed Mr Roettgen's support for an EU register.

Related Content

German retailers oppose tax on drinks packaging 10 Feb 2011

Access to biomaterials still an issue – CEFIC 10 Feb 2011

EU states to adopt ecolabel criteria for detergents 8 Feb 2011

EU chemicals agency facing challenges ahead 7 Feb 2011

EU advised to keep limit for cadmium in food 4 Feb 2011

Environment ministers meet in Luxembourg

The ministers discussed the draft EU ship recycling regulation on 25 October

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Canada Gazette

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Publications

Part I: Notices and Proposed Regulations

Vol. 149 (2015)

ARCHIVED — Vol. 148 (2014)

ARCHIVED — Vol. 147 (2013)

ARCHIVED — Vol. 146 (2012)

ARCHIVED — Vol. 145 (2011)

ARCHIVED — Vol. 144 (2010)

Part I: Quarterly Index

Vol. 149 (2015)

ARCHIVED — Vol. 148 (2014)

ARCHIVED — Vol. 147 (2013)

ARCHIVED — Vol. 146 (2012)

Vol. 149, No. 30 — July 25, 2015

GOVERNMENT NOTICES

DEPARTMENT OF THE ENVIRONMENT

CANADIAN ENVIRONMENTAL PROTECTION ACT, 1999

Notice with respect to certain nanomaterials in Canadian commerce

Pursuant to paragraph 71(1)(*b*) of the *Canadian Environmental Protection Act, 1999*, notice is hereby given that the Minister of the Environment requires, for the purpose of assessing whether the substances described in Schedule 1 to this notice are toxic or are capable of becoming toxic, or for the purpose of

Government of Canada, P.W. and G. S. C. (2015, July 25). Canada Gazette – GOVERNMENT NOTICES. Retrieved July 27, 2015, from http://www.gazette.gc.ca/rp-pr/p1/2015/2015-07-25/html/notice-avis-eng.php

New Zeland

Labelling on cosmetics mandatory from 2015

Environmental Protection Authority Application to Amend the Cosmetic Products Group Standard 2006. , ERMA200782 (2012). Retrieved from http://www.epa.govt.nz/search-databases/HSNO%20Application%20Register%20Documents/ERMA200782_ERMA200782%20Decision%20(28.06.2012).pdf

USA

- **EPA. Two laws**:
  - **TSCA** Toxic Substance Control Act
    - Nano should be “New substance”
    - SNUR Significant new use rules. 90 d/pre-market reg.
    - More than 10 tons/year
  - **FIFRA** Federal Insecticide Fungicide and Rodenticide Act. Pre-market registration
- **FDA**. Guides for industry.
- **Secretary of Commerce**

Sec. Commerce / White House

Policy Principles for the U.S. Decision-Making Concerning Regulation and Oversight of Applications of Nanotechnology and Nanomaterials.

–No vinculante-

http://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/nanotechnology-regulation-and-oversight-principles.pdf

Policy Principles for the U.S. Decision-Making Concerning Regulation and Oversight of Applications of Nanotechnology and Nanomaterials

- *Not to generalize. Each case is a case*
- *Not to block commerce*
- *Favor risk analyze over hazard substitution*
- *Known risks policy*
- *Favor industry confidentiality over transparency to public*

China. New regulation 2010

- No minimum weight for production /import. All nanomaterials included

- Industries should inform

Legislation more strict than in US, But China is the first producer of chemicals!!!

http://www.chemsec.org/news/news-2010/october-december/649-new-chemicals-regulation-in-china

ICCM-SAICM 2012

- To easier data exchange, including risks
- Recommend International Regulatory Guides
- Call for public dialogue, including risks and benefits over the whole lifespan
- Invite International Organizations to capacitate countries
- Call industries to public dialogue
- Invite experts on hazard chemical transportation to consider nano within the GHS (Globally Harmonized System of Classification and Labeling of Chemicals)

SAICM América Latina

2. Workshops: Kingston (2010) y Panamá (2011)

- Enfoque precautorio;
- Etiquetado;
- Registro público nacional;
- Responsabilidad ampliada del productor, etc.

Contents

Brasil

Fecha	Proyecto de ley	Autor	Tópicos	Resultado
04/2005	No. 5.076/2005	Edson Duarte	• Criterio: Principio de Precaución • Reglamentar y orientar investigaciones • Etiquetado • Registro de investigaciones • Estudio de impacto ambiental/salud	Rechazo en 10/2008. Argumentos: • Inhibe inversiones • Normas existentes suficientes • Incrementaría precios por burocracia
05/2010	PLS 131/2010	Tião Viana	• Etiquetar alimentos, medicamentos, cosméticos	Rechazo en 08/2013. Argumentos: • No hay evidencia científica q/ justifique protección • Son muchas técnicas no se puede generalizar • Etiquetado induce a percepción diferente • Puede reducir inversiones • Incrementaría precios por burocracia
03/2013	No. 5.133/2013	Sarney Filho	• Etiquetado para todos los productos • En cosméticos, alimentos y fármacos además del etiquetado la nanomateria prima utilizada	En comisión 11/2013. Realización de audiencia pública
11/2013	PL 6741/2013	Sarney Filho	• Política nacional de nanotecnología • Control de riesgos por el poder público	En comisión: análise conclusiva das comissões de Meio Ambiente e Desenvolvimento Sustentável; de Seguridade Social e Família; de Ciência e Tecnologia, Comunicação e Informática; e de Constituição e Justiça e de Cidadania.

Brasil

- **2011 (Agosto).** Primera reunión para normas y reglamentación. ***Forum de Competividade de Nanotecnologia***. www.desenvolvimento.gov.br/sitio/interna/noticia.php?area=3&noticia=10869

- Propuestas de ley **divorciadas** del trabajo del ***Comité Interministerial de Nanotec.***

México

Año	Institución	Propuesta	Fuente
2005	Comisión de C&T Senado	Declaración a favor de Plan Emergencial de NT	1
2013	Comisión de C&T Senado	Formación de un Programa de I&D en NT	2

1. Comisión de Ciencia y Tecnología. Senado de la República. Dictamen de la Comisión de Ciencia y Tecnología a la propuesta con punto de acuerdo por el que el Senado de la República … 145 *Gaceta Parlamentaria* (2005). www.senado.gob.mx/sgsp/gaceta/index.php?sesion=2005/12/15/1&documento=1012.
2. Robles-Montoya, A. (2013). Proposición al Senado de la República relativo al diseño de un programa de investigación y desarrollo de la nano ciencia y la nanotecnología. *Senado de la República. LXLI Legislatura del Congreso de la Unión.*

México

2010: Calderon & Obama. Se forma el **High Level Regulatory Cooperation Council US-Mex (HLRCC)**. En el marco de los tratados comerciales. En torno a 6 sectores:

- 1. Alimentos
- 2. Transporte
- 3. **Nanotecnología**
- 4. Electronic Health Certification
- 5. Oil & gas offshore standards
- 6. Reconocimiento mutuo de certificaciones y laboratorios

México

- 2012. "***Lineamientos para regulaciones sobre nanotecnologías para impulsar la competitividad y proteger al medio ambiente, la salud y la seguridad de los consumidores***"

  - *Documento **NO-vinculante**. Elaborado por Comisión Ad Hoc coordinada por el CENAM-Sec. Economía*

<reproduce sin mayor diferencia el documento de USA>

México: normas ISO 2014

- NMX-R-10867-SCFI-2014 Caracterización de **nanotubos de carbono de una capa** mediante espectroscopia de fotoluminiscencia en el infrarrojo cercano
- NMX-R-10929-SCFI-2014 Caracterización de muestras de **nanotubos de carbono de múltiples capas**
- NMX-R-27687-SCFI-2014 Terminología y **definiciones** para nano-objetos- nanopartícula, nanofibra y nanoplaca
- NMX-R-80004-1-SCFI-2014 Nanotecnologías; **Vocabulario-**Parte 1: Conceptos básicos
- NMX-R-80004-3-SCFI-2014, Nanotecnologías- **Vocabulario-**Parte 3: Nano-objetos de carbono

Gracias
Thank you

gfoladori@gmail.com
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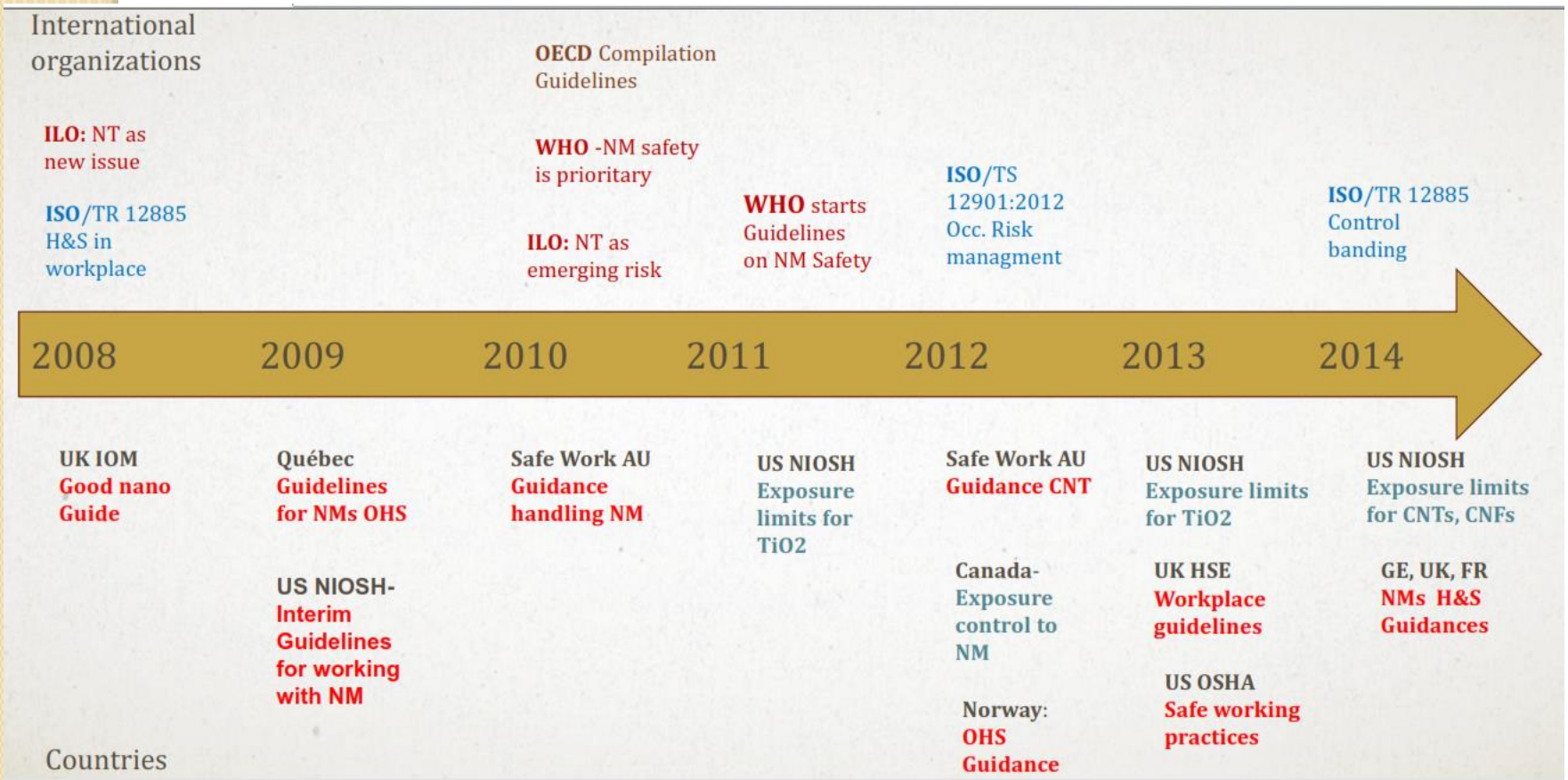
International organizations
ILO: NT as new issue
ISO/TR 12885 H&S in workplace
OECD Compilation Guidelines
WHO -NM safety is prioritary
ILO: NT as emerging risk
WHO starts Guidelines on NM Safety
ISO/TS 12901:2012 Occ. Risk managment
ISO/TR 12885 Control banding
2008
2009
2010
2011
2012
2013
2014
UK IOM Good nano Guide
Québec Guidelines for NMs OHS
US NIOSH- Interim Guidelines for working with NM
Safe Work AU Guidance handling NM
US NIOSH Exposure limits for TiO2
Safe Work AU Guidance CNT
Canada- Exposure control to NM
Norway: OHS Guidance
US NIOSH Exposure limits for TiO2
UK HSE Workplace guidelines
US OSHA Safe working practices
US NIOSH Exposure limits for CNTs, CNFs
GE, UK, FR NMs H&S Guidances
Countries

Table 1. Common nanotechnology definitions

Source	Definition
US: National Nanotechnology Initiative (2001-)	Nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications. Encompassing nanoscale science, engineering and technology, nanotechnology involves imaging, measuring, modelling, and manipulating matter at this length scale.
EU: 7th Framework Programme (2007-2013)	Generating new knowledge on interface and size-dependent phenomena; nano-scale control of material properties for new applications; integration of technologies at the nano-scale; self-assembling properties; nano-motors; machines and systems; methods and tools for characterisation and manipulation at nano dimensions; nano precision technologies in chemistry for the manufacture of basic materials and components; impact on human safety, health and the environment; metrology, monitoring and sensing, nomenclature and standards; exploration of new concepts and approaches for sectoral applications, including the integration and convergence of emerging technologies.
Japan: Second Science and Technology Basic Plan (2001-2005)	Nanotechnology is an interdisciplinary S&T that encompasses IT technology, the environmental sciences, life sciences, materials science, etc. It is for controlling and handling atoms and molecules in the order of nano (1/1 000 000 000) meter enabling discovery of new functions by taking advantage of its material characteristics unique to nano size, so that it can bring technological innovation in various fields.
ISO TCC 229	Understanding and control of matter and processes at the nanoscale, typically, but not exclusively, below 100 nanometers in one or more dimensions where the onset of size-dependent phenomena usually enables novel applications. Utilising the properties of nanoscale materials that differ from the properties of individual atoms, molecules, and bulk matter, to create improved materials, devices, and systems that exploit these new properties.
European Patent Office	The term nanotechnology covers entities with a geometrical size of at least one functional component below 100 nanometers in one or more dimensions susceptible of making physical, chemical or biological effects available which are intrinsic to that size. It covers equipment and methods for controlled analysis, manipulation, processing, fabrication or measurement with a precision below 100 nanometers.