

# Environmental Measuring for the regulation and control of chemicals and nanomaterials

## 3rd. TRI-NATIONAL WORKSHOP ON STANDARDS FOR NANOTECHNOLOGIES

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Querétaro, MEXICO

# Contents

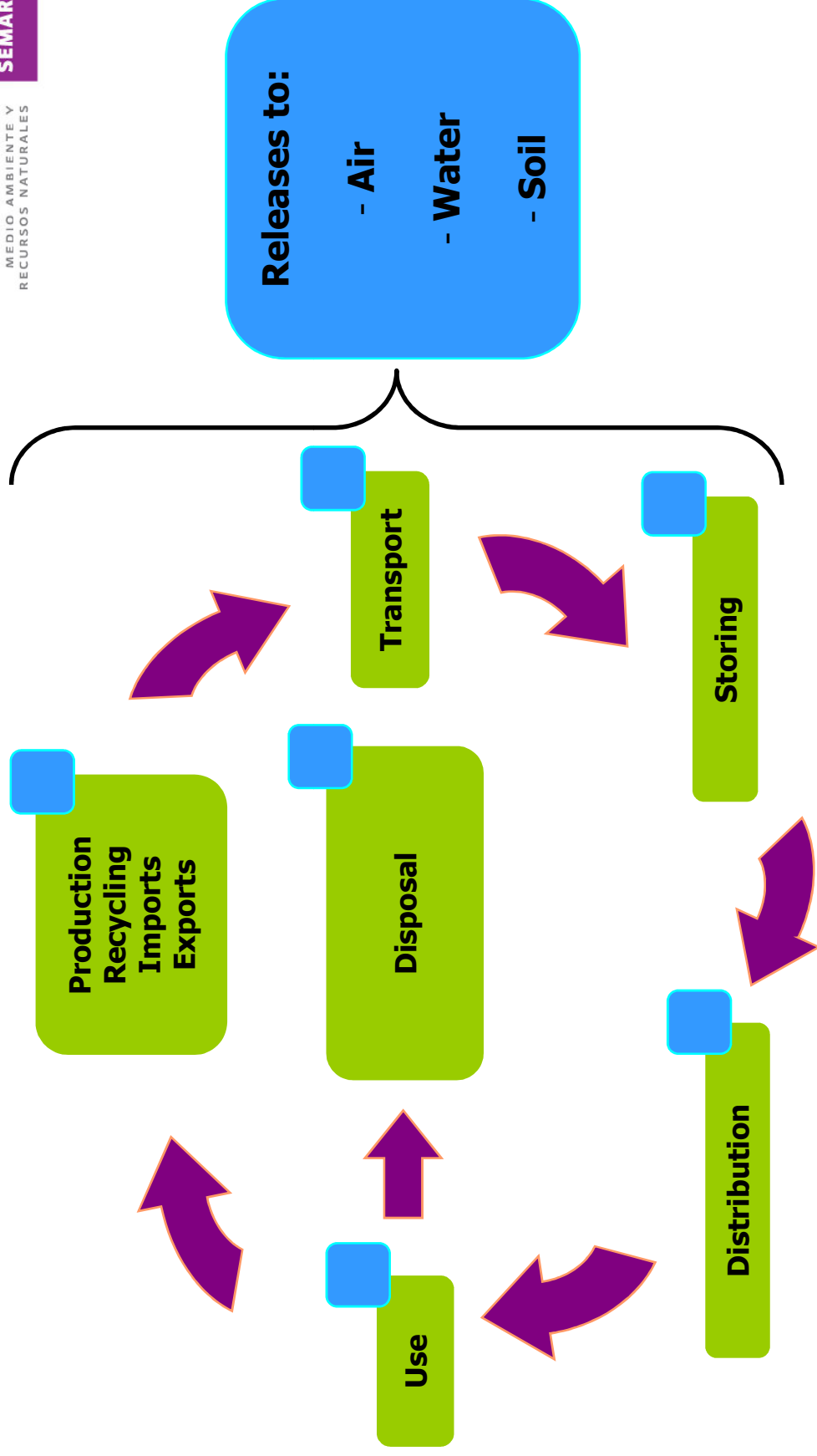
- General concepts
  - Chemicals
  - Risk evaluation
- Importance of chemicals regulation
- Chemicals regulation in Mexico
- National Institute of Ecology functions
- Importance and challenges of nanomaterials environmental measuring

# Chemicals

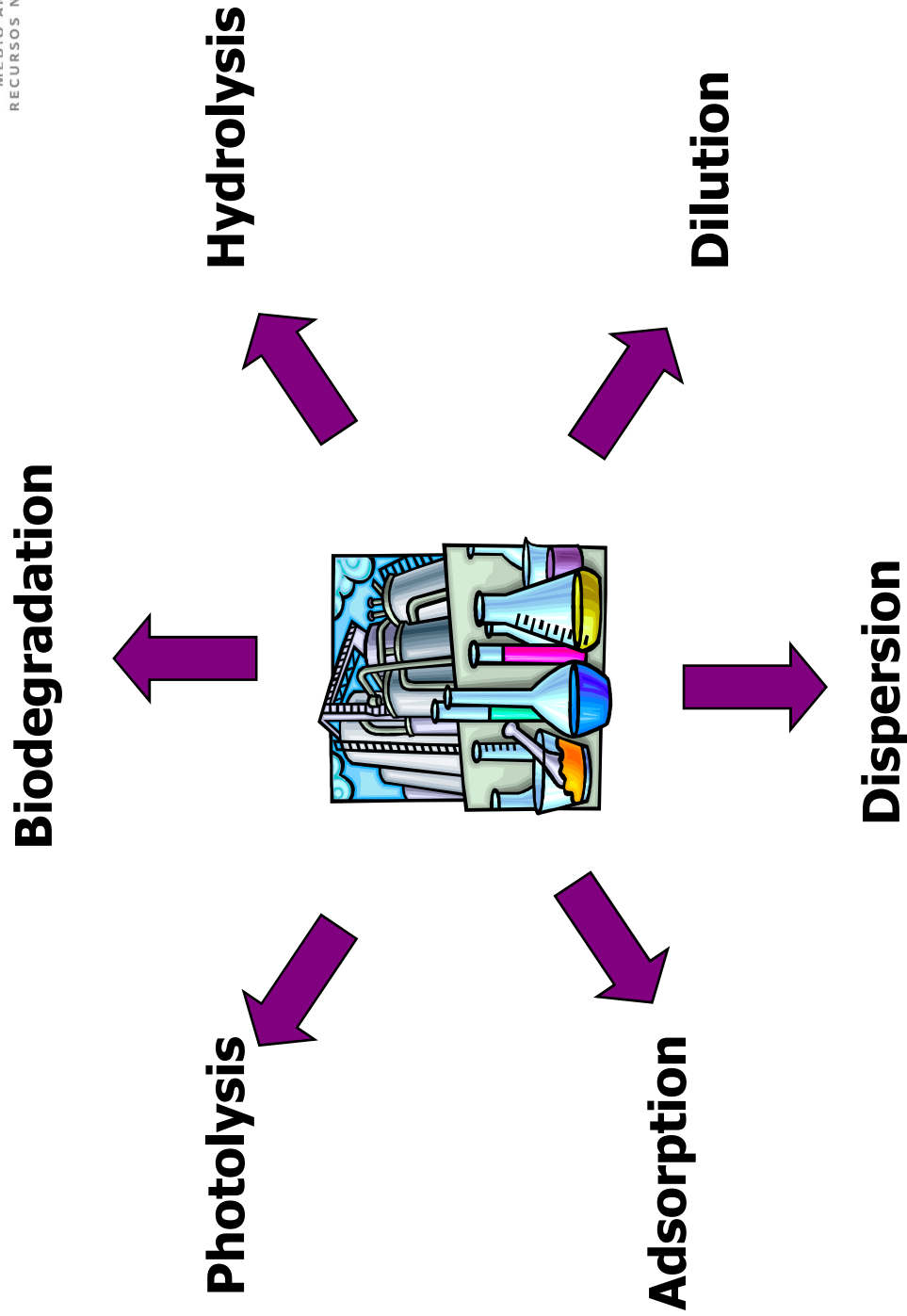
- Chemical industry is one of the biggest sectors in the global economy
- The use of chemicals has great benefits and considerably contributes to improve our life quality.
- Chemicals are essential in:
  - **Manufacture of many products (raw materials)**
  - **Food production**
  - **Diseases prevention and treatment**
  - **Cleaning products**
  - **Transport (Fuel)**



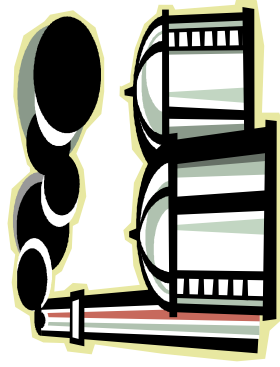
# Chemicals life cycle and environmental releases



# Chemicals Environmental Fate



# Chemicals – Organism Interaction



**SOURCE**  
(Chemicals)

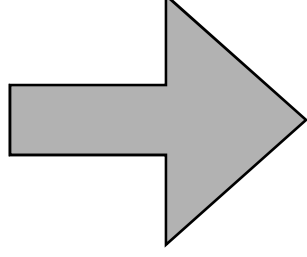
**EXPOSURE**  
(Air, water, soil, food)



**TARGET**  
**ORGANISMS**



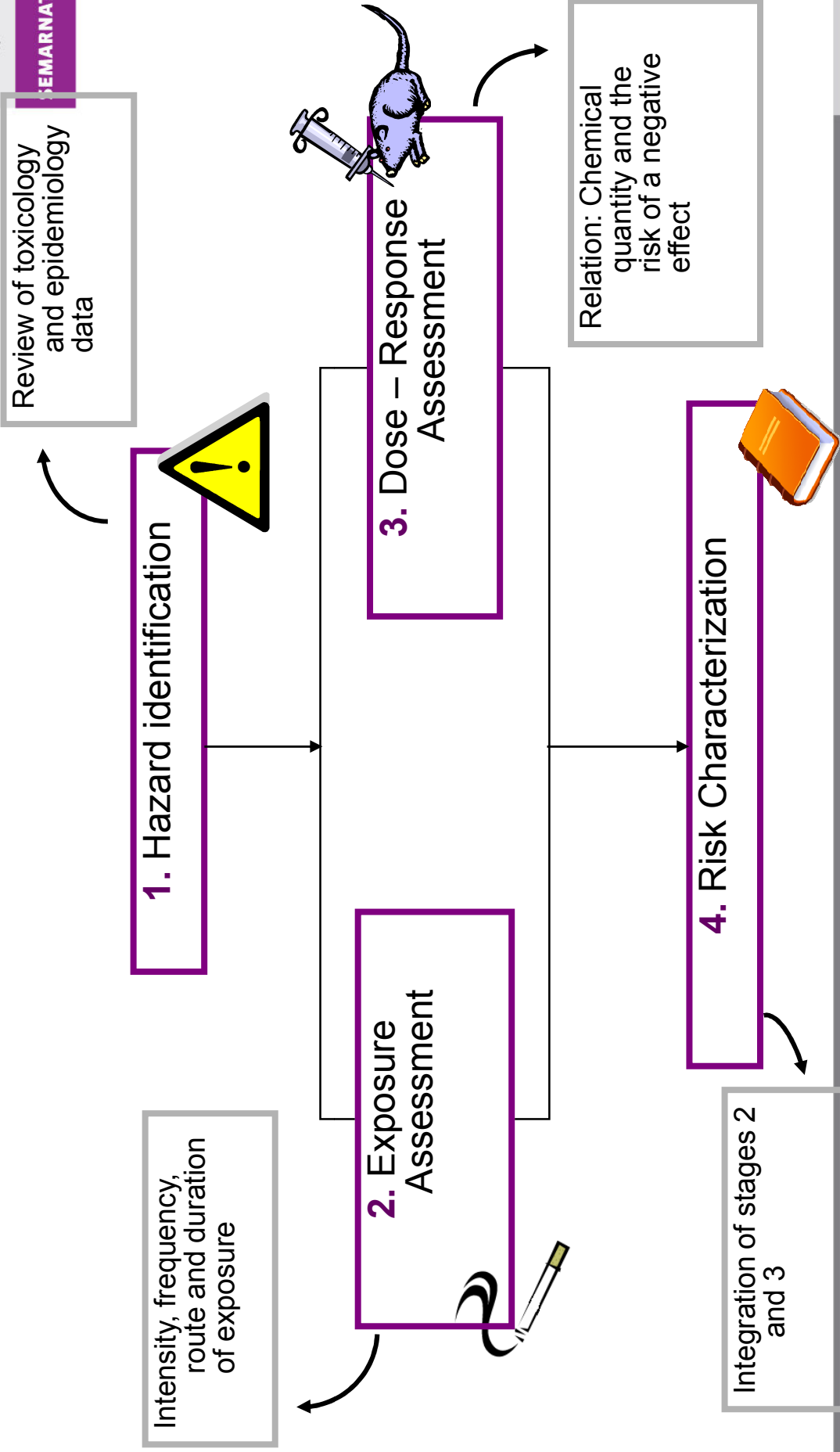
# ¿How do we know there's a chemical exposure risk?



**RISK ASSESSMENT**

# Risk Assessment

## COMPONENTS





# Risks associated to chemicals and the need to control them

- Once there are known the chemicals' risks, the need to **regulate** and **control** them arises
- The aim of the regulation and control of chemicals is to **reduce** the human and environmental **adverse effects**



# Legal instruments for the regulation and control of chemicals in Mexico

General



Particular

Political Constitution
Laws / International Conventions and Treaties
Regulations / Plans / Programs
Norms / Standards
Agreements
Acts
Procedures
Registries
Inspections
Sanctions
Voluntary Programs

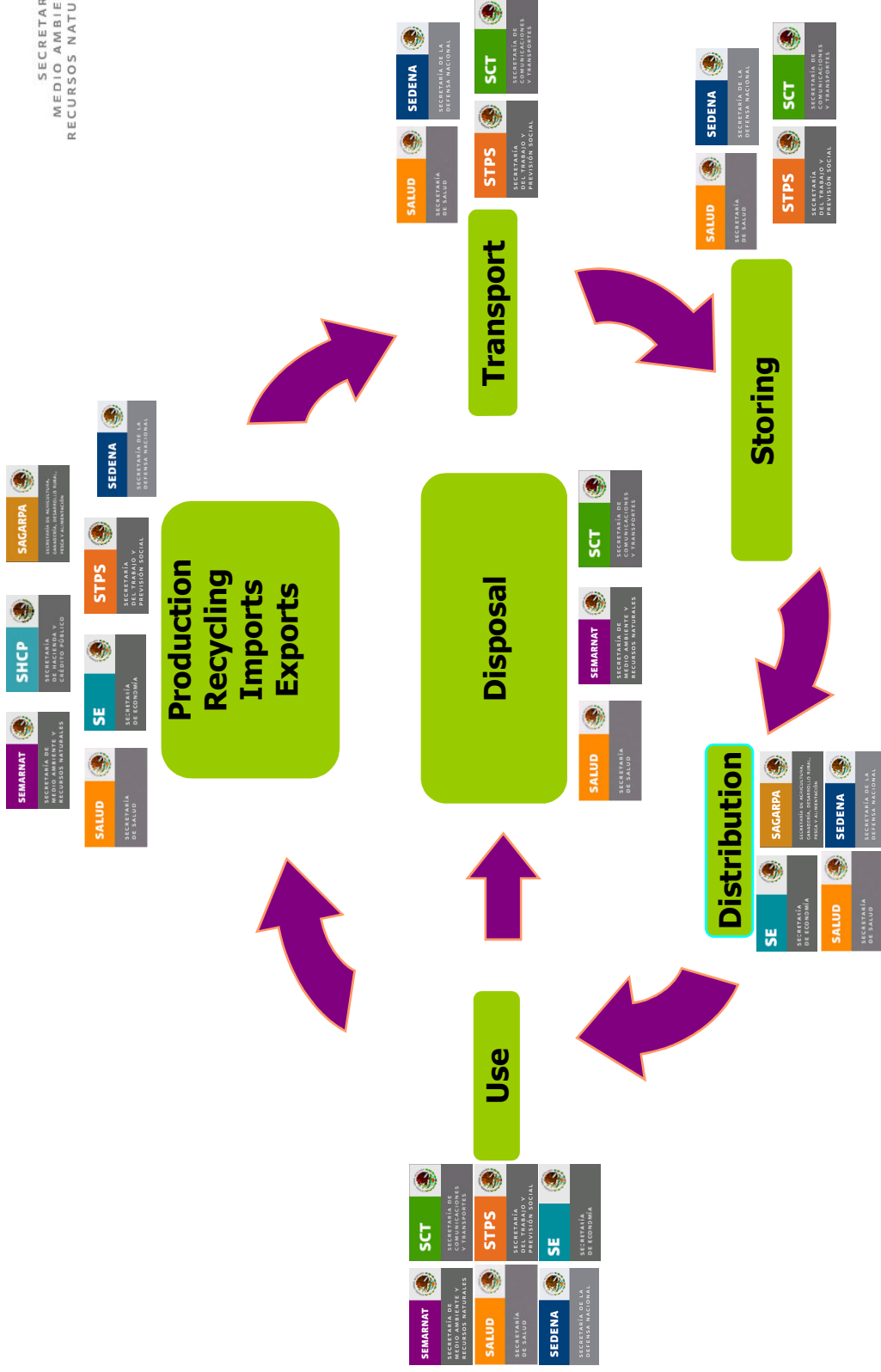


# Control and regulation of chemicals in Mexico

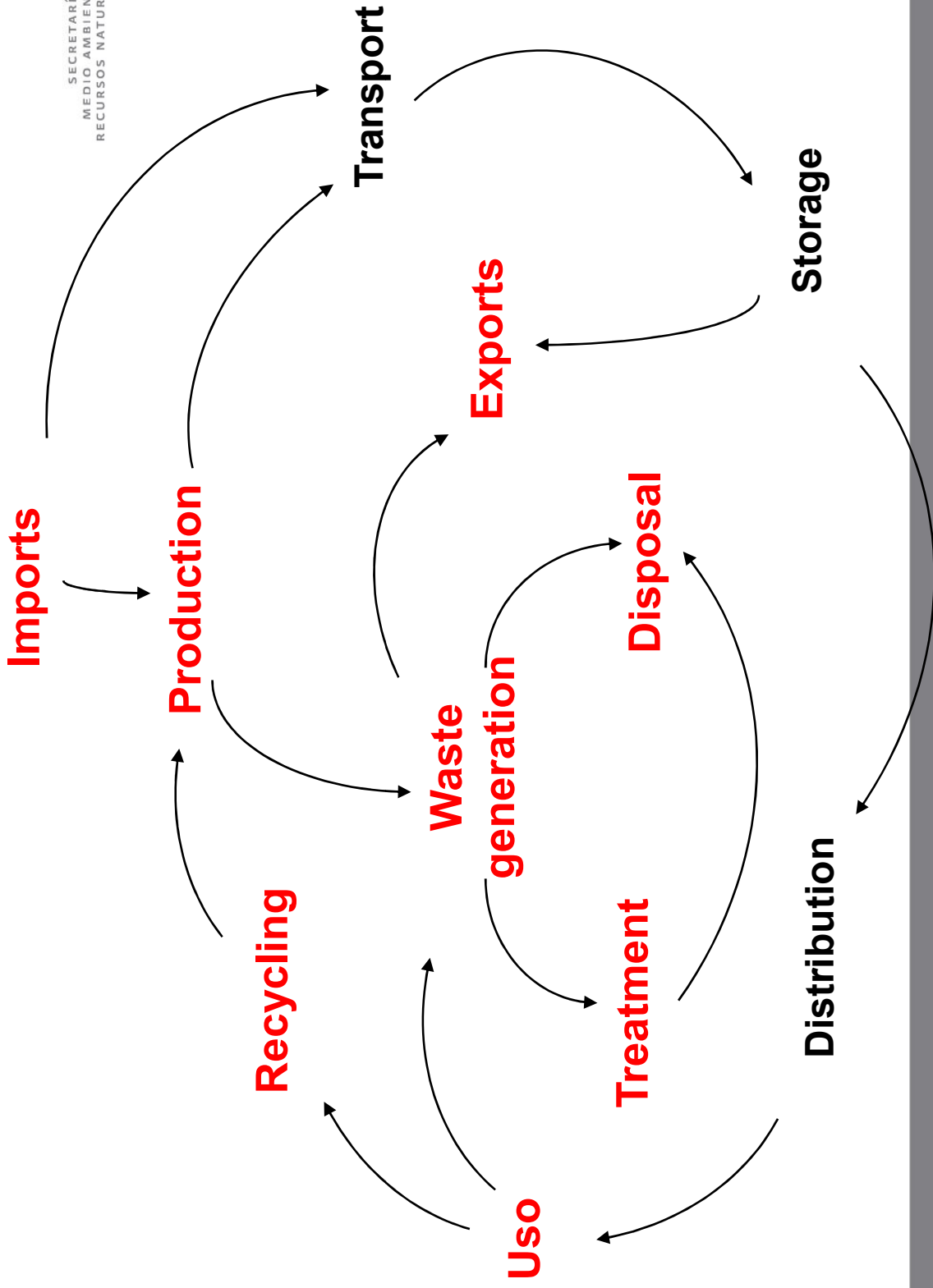
## Mexico



SECRETARÍA DE MEDIO AMBIENTE Y RECURSOS NATURALES



# Environment Ministry functions for chemicals management



# Environment Ministry (SEMARNAT) instruments for chemicals management



Instituto Nacional de Ecología



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SEMARNAT

- General Law of Ecological Balance and Environmental Protection (LGEEPA)
- General Law for the Prevention and Integral Management of Wastes (LGP GIR)
- National Water Law
- Regulations
- Norms (Standards)

# National Institute of Ecology (INE)



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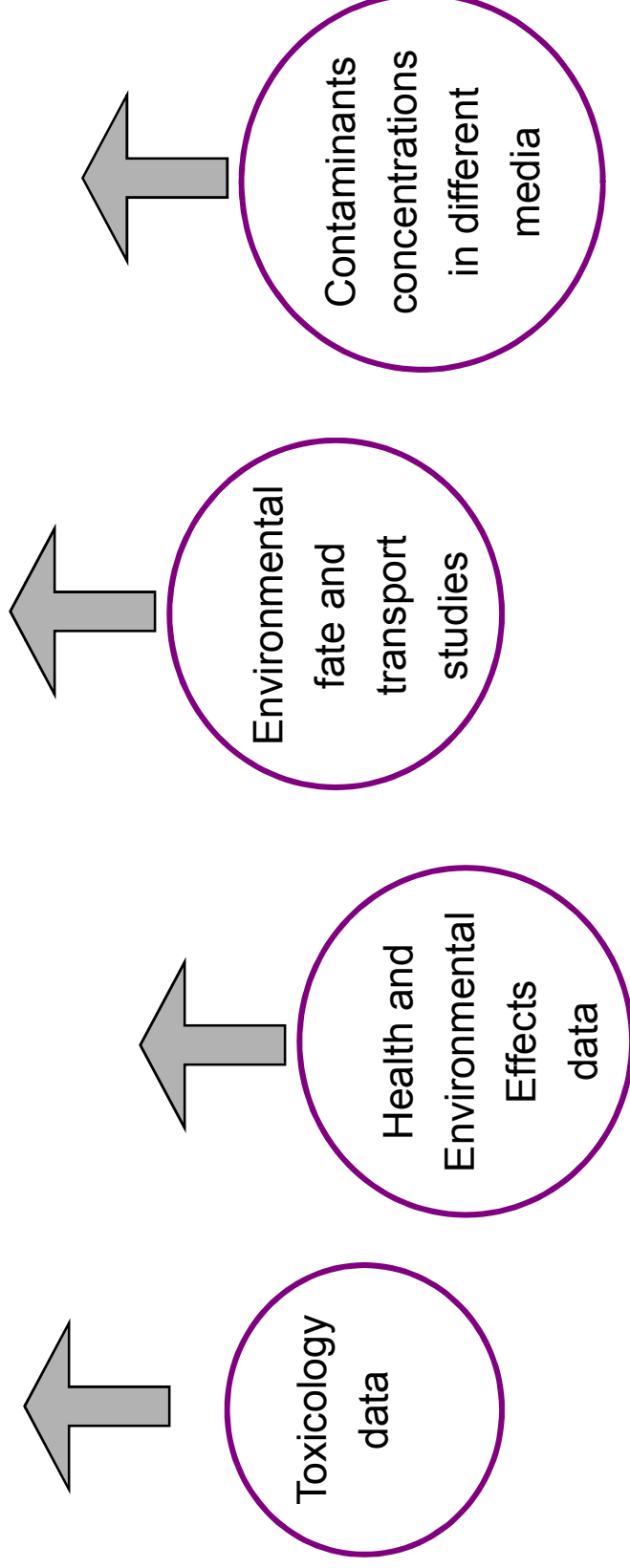
SEMARNAT

## FUNCTIONS

- Give **scientific and technical support** to the Environment Ministry management units
- Coordinate, promote and develop **scientific research** to make and guide policies for:
  - **Pollution prevention and control**
  - **Hazardous materials and waste management**
  - **Ecotoxicological risk assessment**

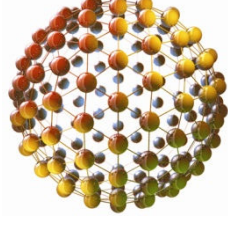
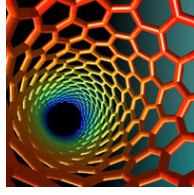
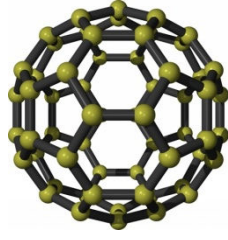
# National Institute of Ecology (INE)

- Identify pollution agents and effects in ecosystems and human health
- Propose efficient pollution prevention and control alternatives
- Prevent and reduce environmental risks



# Environmental concerns on nanomaterials

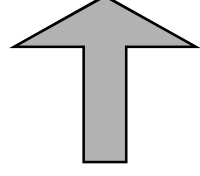
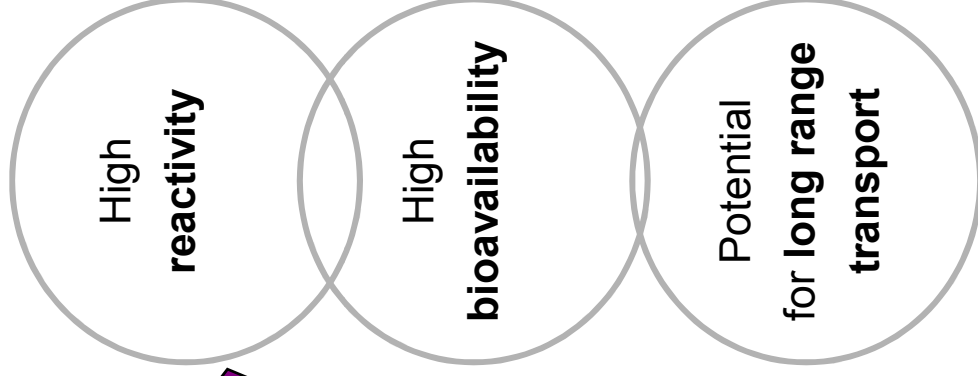
- Nanomaterials presence in the market is increasing since they are included in several materials and products
- The nanomaterials inner properties make them highly reactive
- Nanomaterials inner properties may play important roles in their distribution through the body, and their possible toxicity





# Environmental concerns on nanomaterials

- Particle size
- High surface area to volume ratio
- Shape
- Chemical composition
- Charge
- Aggregation potential



# Concerns on nanomaterials

Little is known about the human and environmental potential risks associated to nanomaterials use

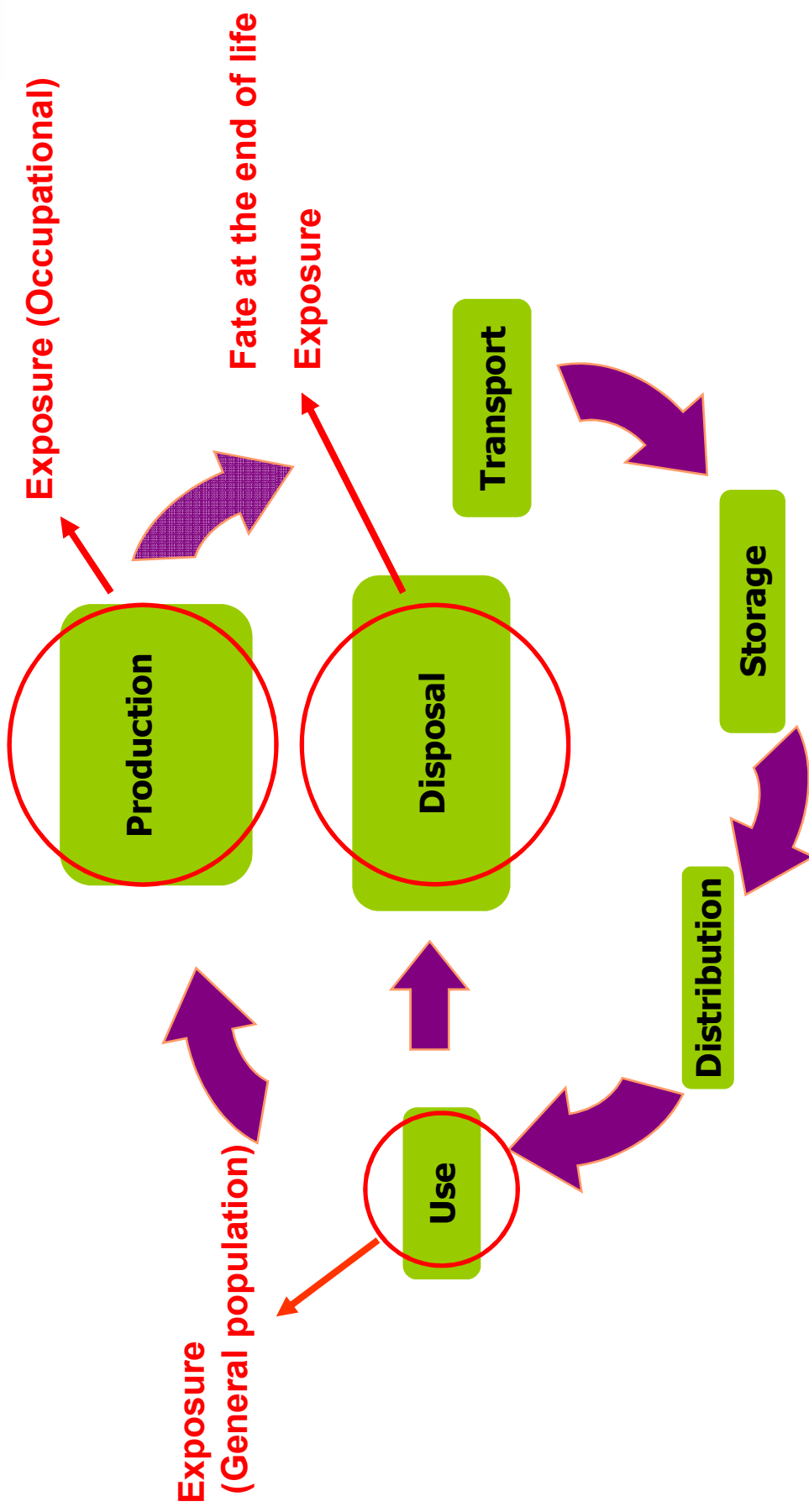
- It is not clear whether and how they are taken up in the body, distributed, metabolised, accumulated and secreted
- Potential negative impacts of their breakdown products
- Unknown interactions with other contaminants
- Non-conclusive studies on nanoparticles enter to biological systems, translocation between organs, oral ingestion, dermal exposure, etc.

# Environmental Concerns on nanomaterials

- Nanoparticles can be taken up by organisms in the environment
  - Storage of lipophilic nanoparticles in fatty tissues
  - Concentration in the food-chain
  - Accumulation of persistent nanoparticles in ecosystems and organisms if there are no pathways for their breakdown or excretion

Lack of the scientific information and methodological basis to carry out a robust risk assessment of nanomaterials

# Main stages in nanomaterials life cycle

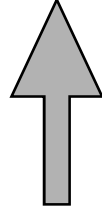


# Nanomaterials

**WE WANT TO KNOW...**

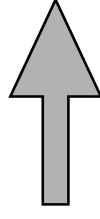
**¿HOW?**

¿Are the workers exposed?



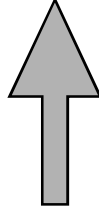
Quantitative and qualitative exposure determination in work places

¿Are the general population and organisms exposed?



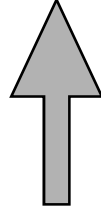
Quantitative and qualitative exposure determination in sites

¿Where are they?



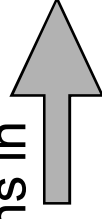
Detection in water, air, soil, sediment and organisms

¿How much?



Measuring in different media

¿Do the suffer transformations in the environment?



Deposition, agglomeration, aggregation, degradation, oxidation

# Obstacles in nanomaterials environmental analysis

- Trace levels in the environment
- Presence of other nanomaterials of non-interest (natural, incidentally formed)
- Particle size changes (Agglomeration, aggregation, condensation)
- Chemical Impurities / Interferences
- Lack of suitable methods to measure nanomaterials in the environment
- Lack of quality control reference materials
- Lack of standard analytical methods

# Elements needed to clarify our doubts regarding nanomaterials

- Inventories to know data related to imports, manufacture and use of nanomaterials
- Life Cycle Analysis to know the nanomaterials environmental fate
- Analysis methods to identify nanomaterials en different media (water, air, soil and organisms)
- Reference materials

# INE Activities

## to study nanomaterials



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- *Assessment of the development, manufacture and use of nanomaterials in Mexico. INE-IPICYT (2008-2009) sponsored by UK (Defra)*
- *National Workshop on the development, manufacture and use of nanomaterials. Centro de Investigaciones en Optica (CIO), León, Gto. May 2008*
- *International Workshop on the development, manufacture and use of nanomaterials. ITESM, Monterrey. December 2008.*



# Recommendations gathered in the National and International Workshops



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SEMARNAT

- Creation of research networks among different sectors (academy, industry, government) for the development of a joint effort to satisfy the country needs
- Planning a regulation more focused on prevention, not on control
- Communicate to society the present situation regarding Nanotechnology development in Mexico with emphasis on the risks associated to nanomaterials use

# Conclusions

- There is an important need to **increase our knowledge** in several aspects of nanomaterials
- Several hurdles and challenges in **environmental analysis** of nanomaterials
- As we **clarify our doubts**, we will be able to **better assess the risks associated to nanomaterials** and **reduce the potential negative impacts**.

**¡Thank you!**

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