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Concepts on how to Establish a Framework of Release of Nanomaterials

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Why a framework of release?

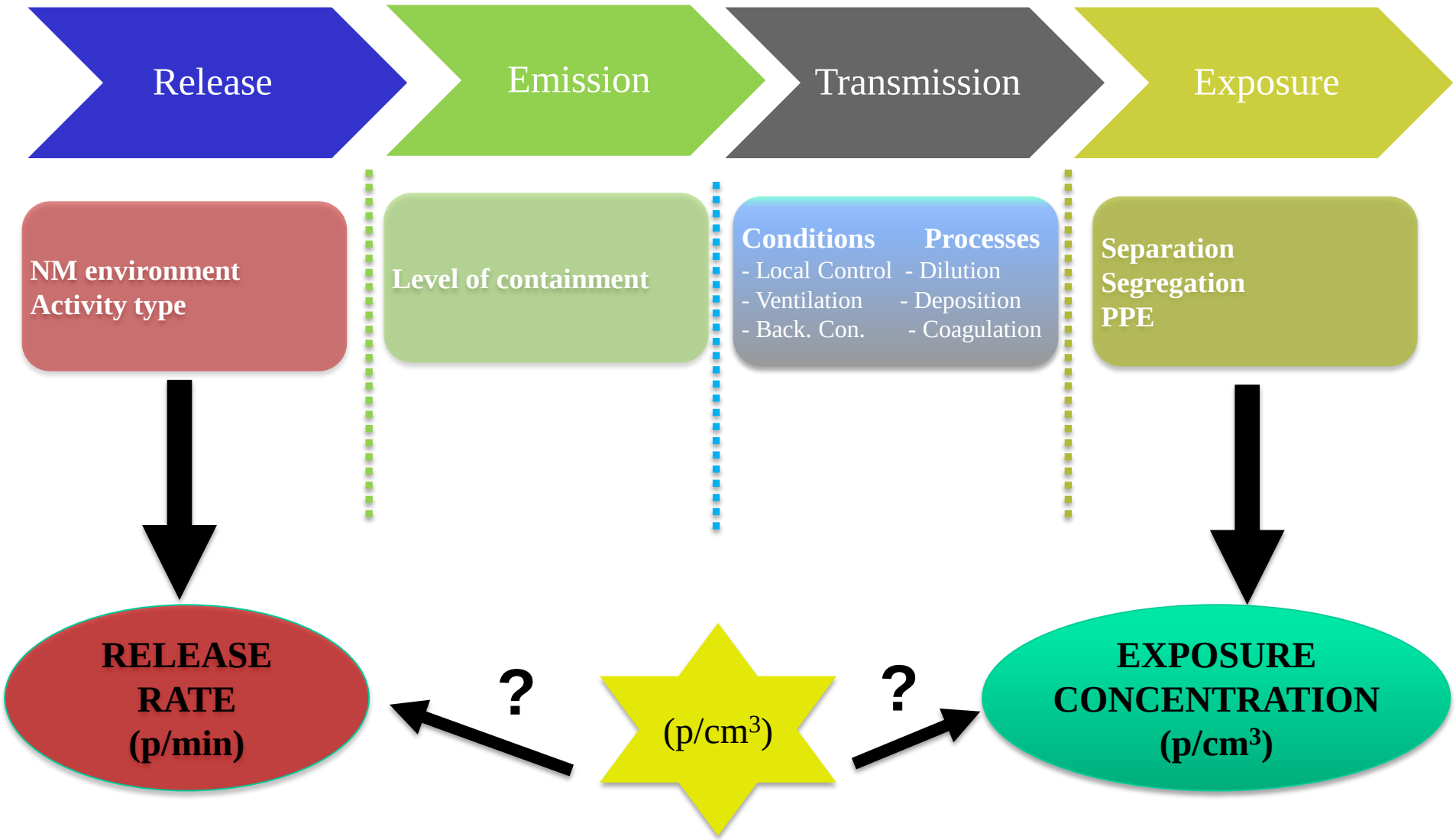
- Exposure to engineered nanomaterials (ENM) is seen critical due to possible health implications
- Exposure measurements well established in occupational settings, less so during other life-cycle stages
- Release is a pre-requisite for exposure but not systematically studied
- Release can occur at different stages of the ENM life cycle

Why a framework?

- Systematic information gathering, facilitating safe-by-design and green nano approaches
- Extending the possibilities on linking ENM release and exposure
- Grouping of release scenarios minimizes experimental efforts

The first developments of the framework presented today are focussed on release into air and possible airborne exposure

From release to exposure (occupational)



Release processes / mechanisms

mechanical processes

- sanding
- drilling
- sawing
- milling
- cutting/shredding
- dustiness
- mechanical shock
- wash off
- ……

thermal processes

- thermal stress
- incineration
- combustion
- …..

chemical processes

- reactive liquids / gases
- dissolution
- ……

mixed processes

- weathering (degradation and abrasion)
- mechanical processes: thermal stress usually present
- …..

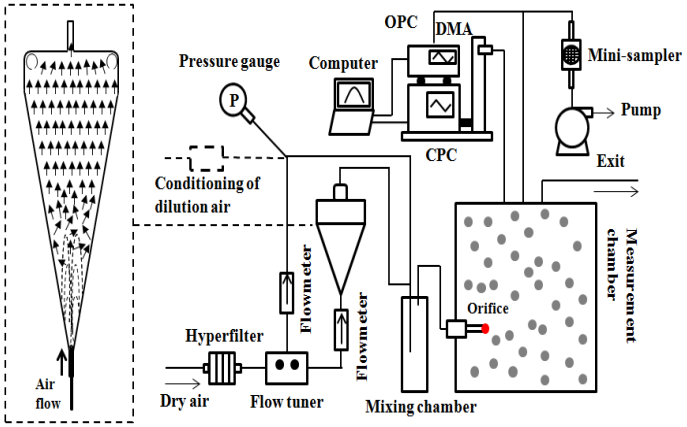
Methods to determine emissions from powders

Activity type
Pouring
Mixing/Stirring
Bagging
Pelletizing
Ball milling
Injection moulding
High energy close operations (leaks)

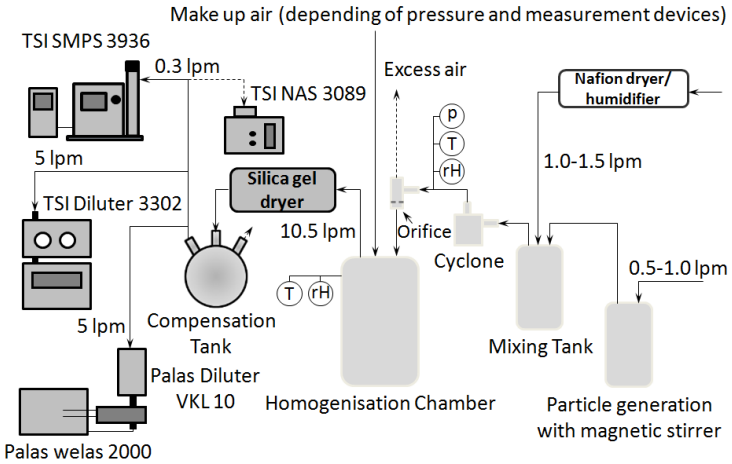
Principle	Simulation Method
Dustiness	Continuous drop
	Rotating drum
	Vortex
Deagglomeration	Rheogram
	Critical orifice
	High speed aerosolization

MARINA methods to determine emissions from powders

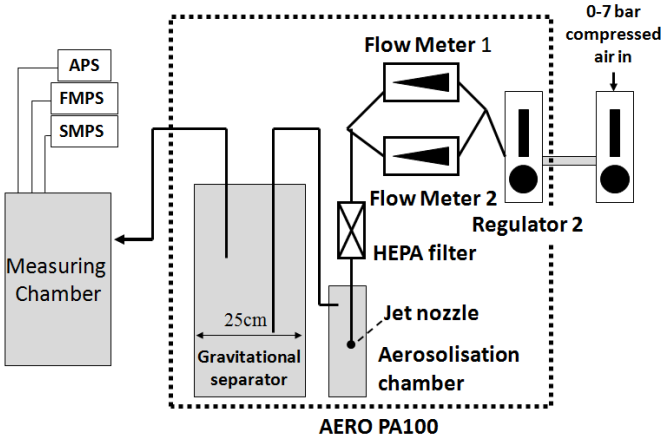
Fluidized bed (Funnel)



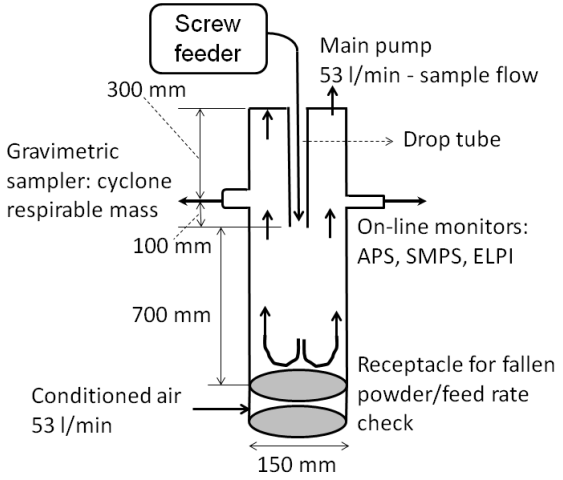
Magnetic stirrer



Air-jet aerosolizer

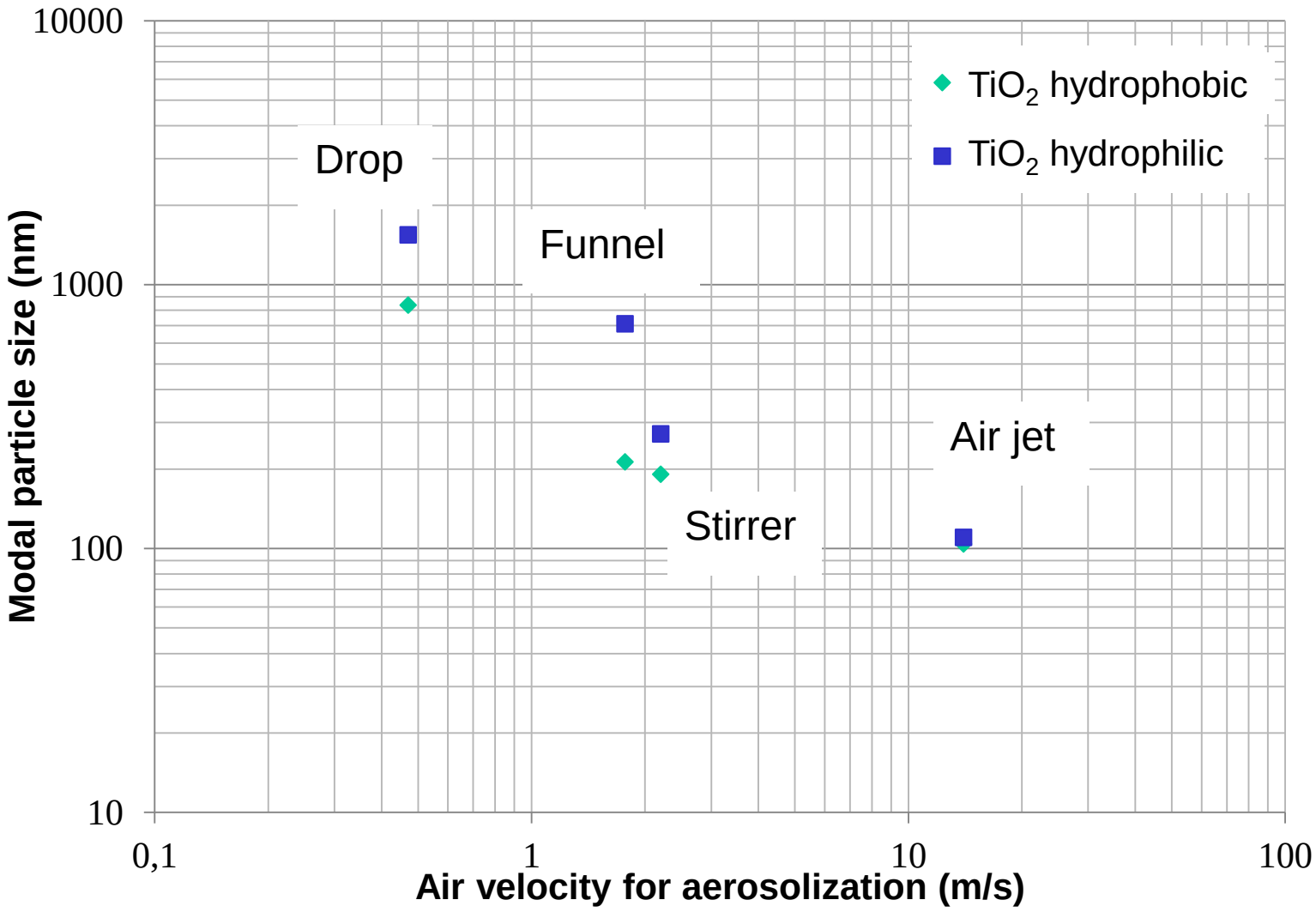


Continous drop



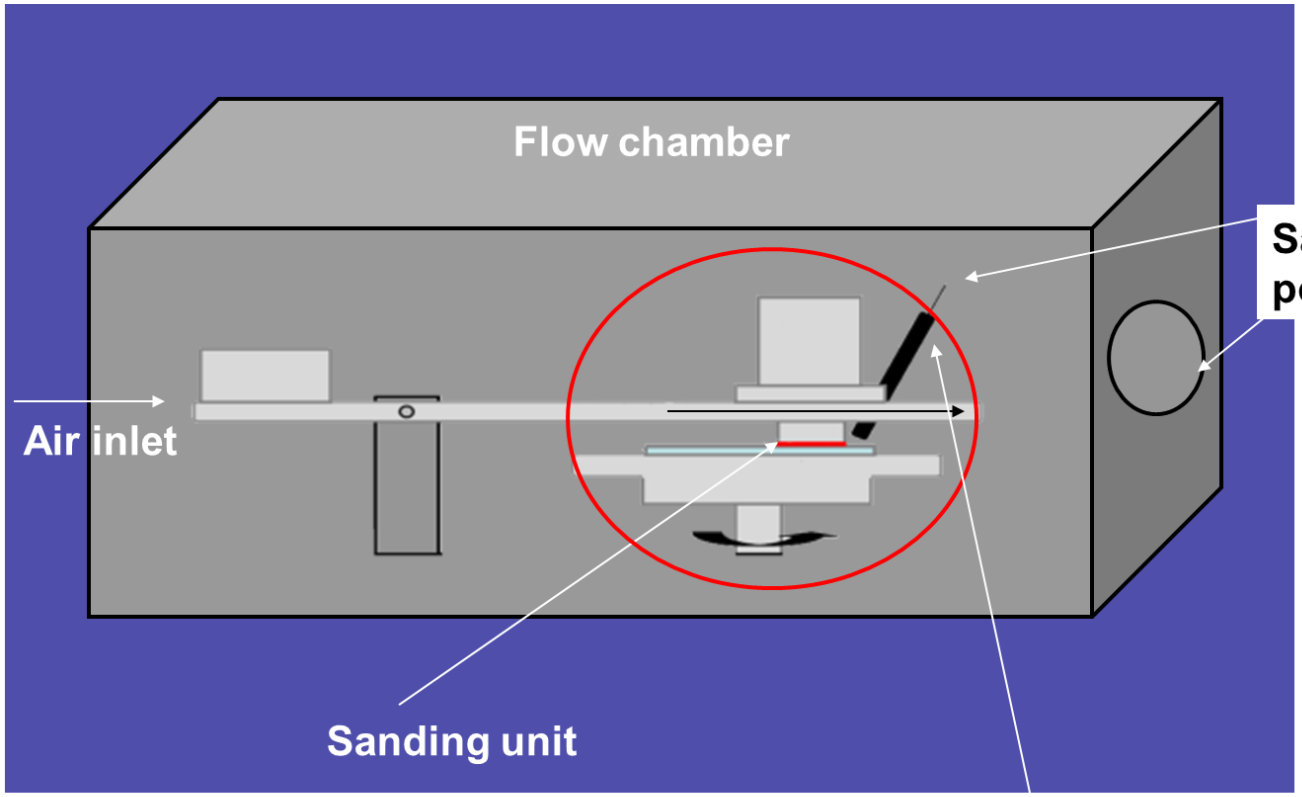
Ding et al. Aerosol Science and Technology, 49:1222–1231, 2015

Emissions from powders

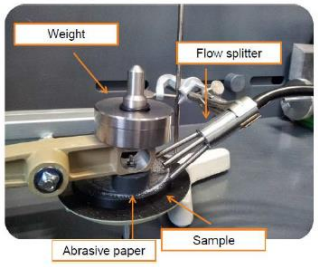


Adopted from Ding et al. Aerosol Science and Technology, 49:1222–1231, 2015

Example sanding tests (principle setup)

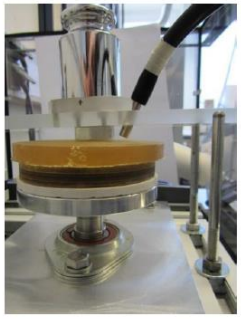


CEA



BASF

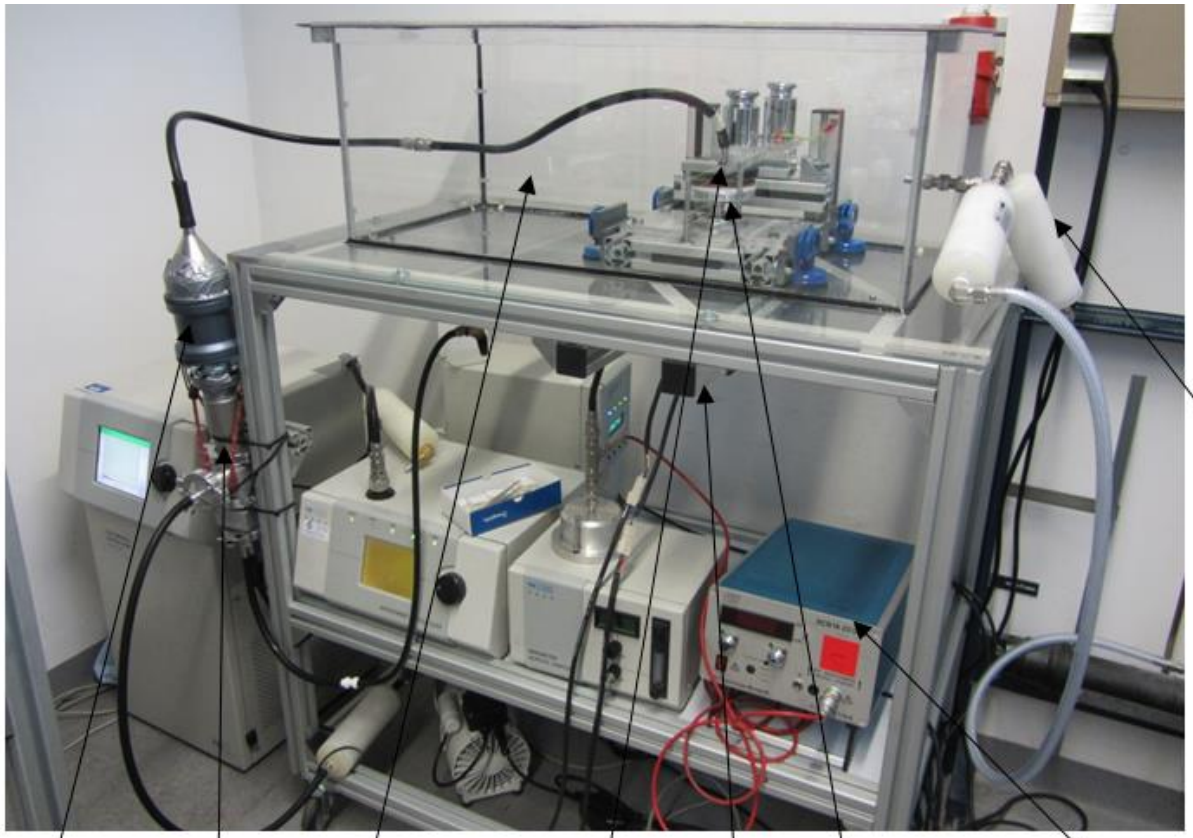
IUTA



MARINA round robin test
CEA, BASF, IUTA

MARINA
MANAGING RISKS OF NANOMATERIALS

Details of sanding test stand (IUTA)



Air Inlet

Pre-separator

Flow Chamber

Motor

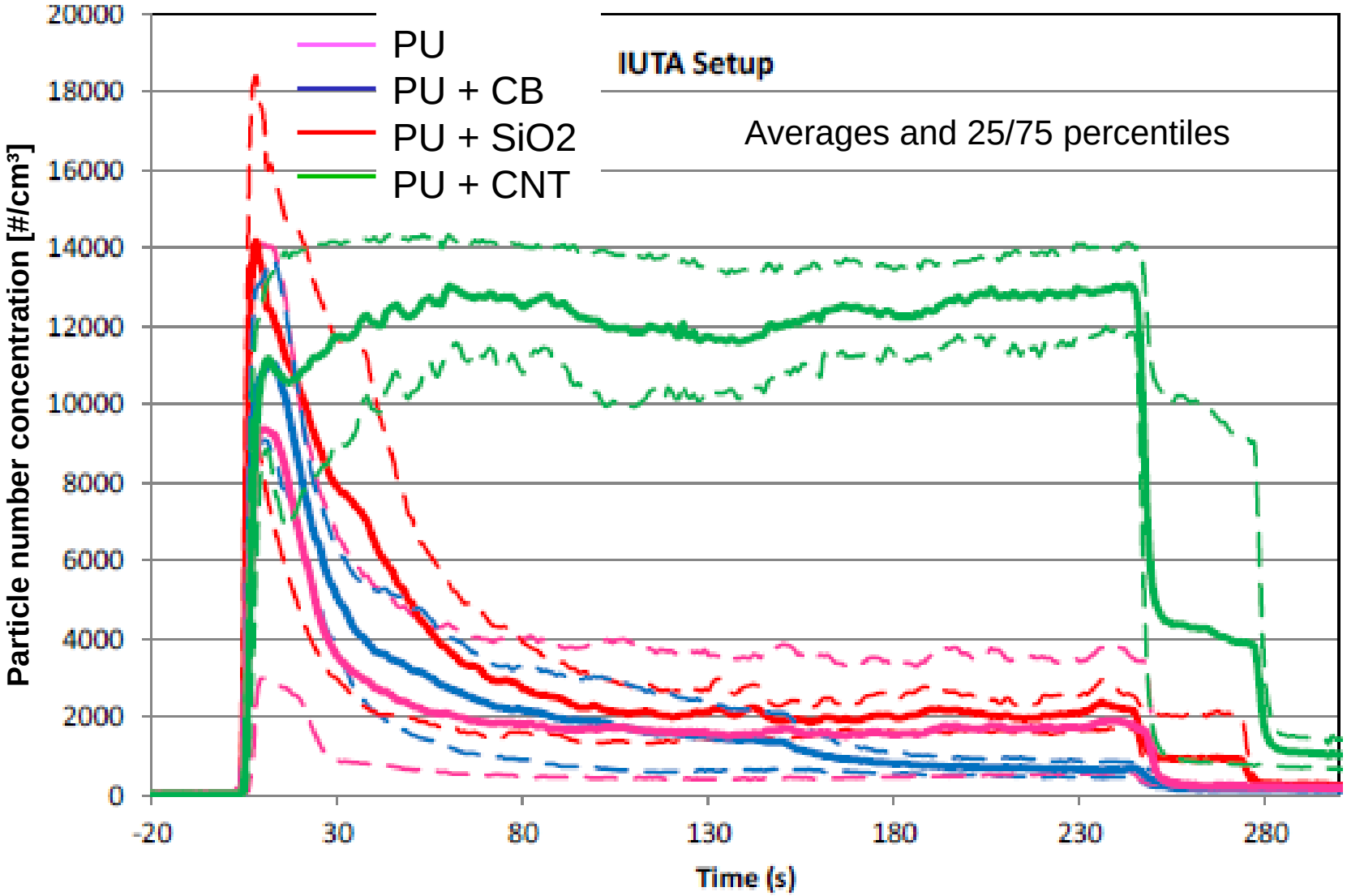
Instrumentation

Isokin. Sampling

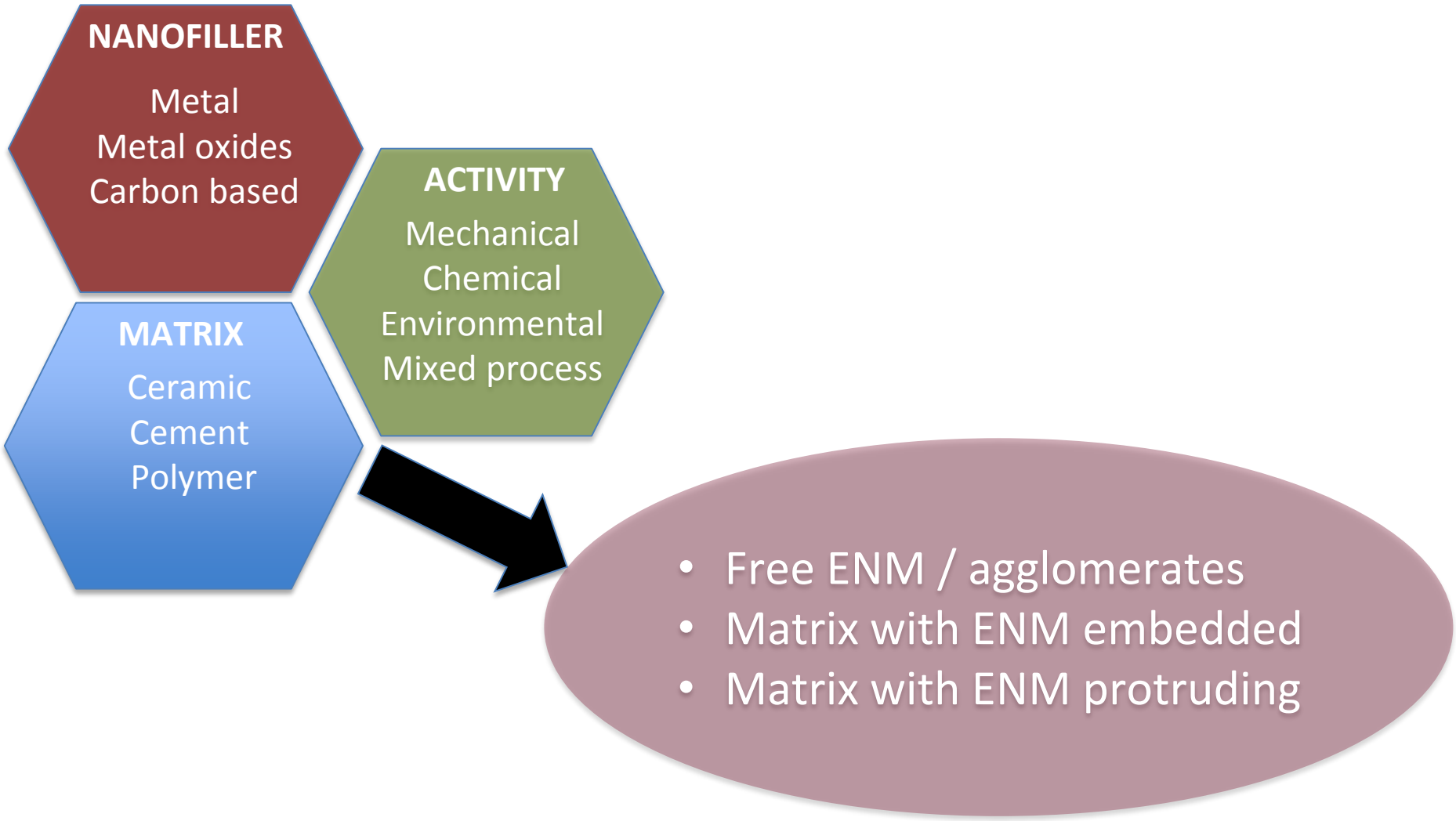
Sampling Position

Sanding Apparatus

Sanding of different materials



Airborne release from nanocomposites



Framework for ENM release (Occupational)

Material Properties

Powder

-Dustiness/deagglomeration

-Shape

-Adhesive forces

-Moistness

Nanocomposite

-Matrix characteristics

- ENM :
  - deposited on surface (chemically bonded, physically adsorbed)
  - Embedded in matrix

Liquid

-Vapour pressure

-Viscosity

Processes

Chemical

-Oxidation

- Matrix dissolution

-.....

Mechanical

-Abrasion

-Cutting

-Drilling

-Pouring

-Sanding

-.....

Thermal

- Thermal degradation

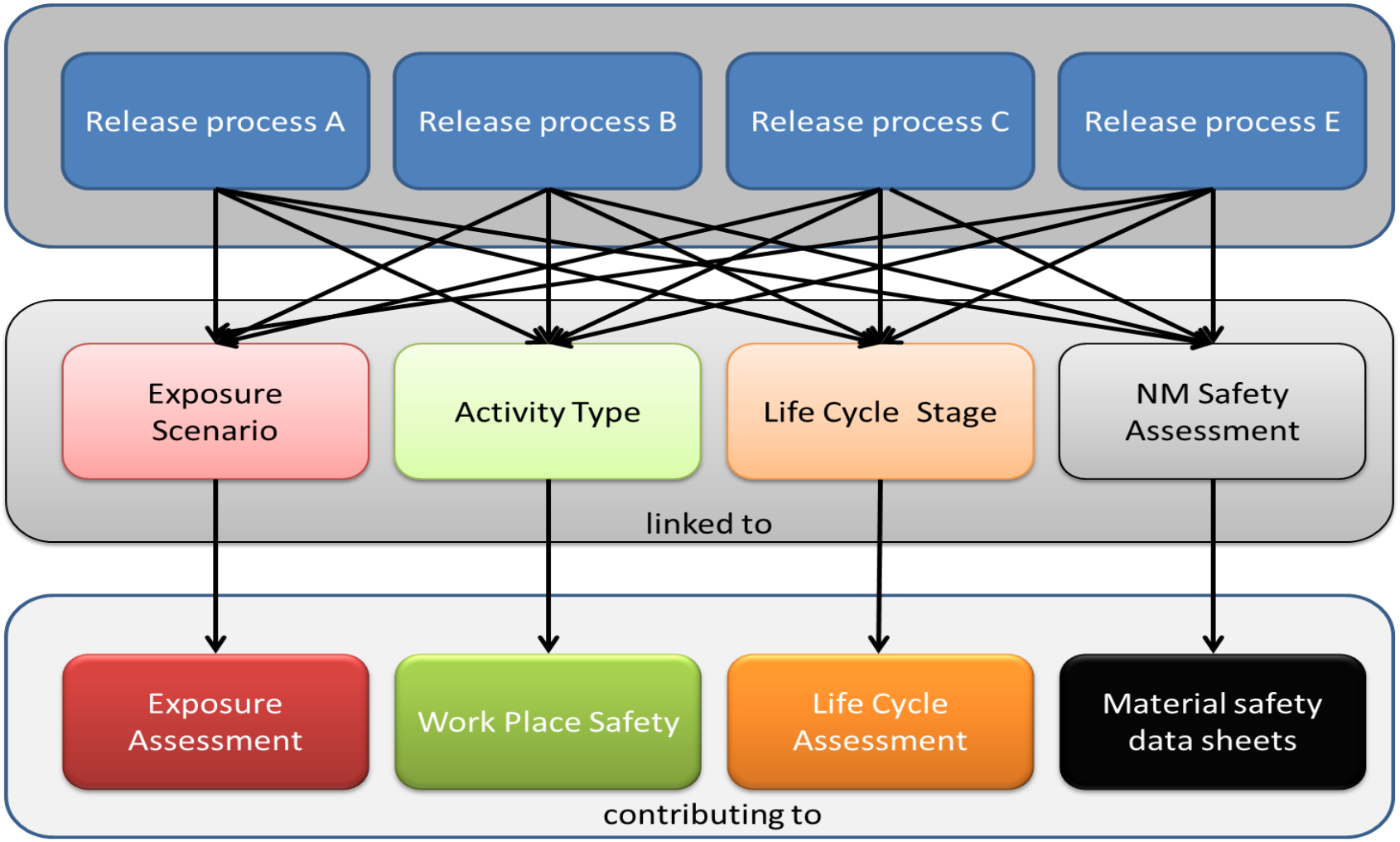
- Combustion

- .....

RELEASE SCENARIO

EMISSION ASSESSMENT METHOD

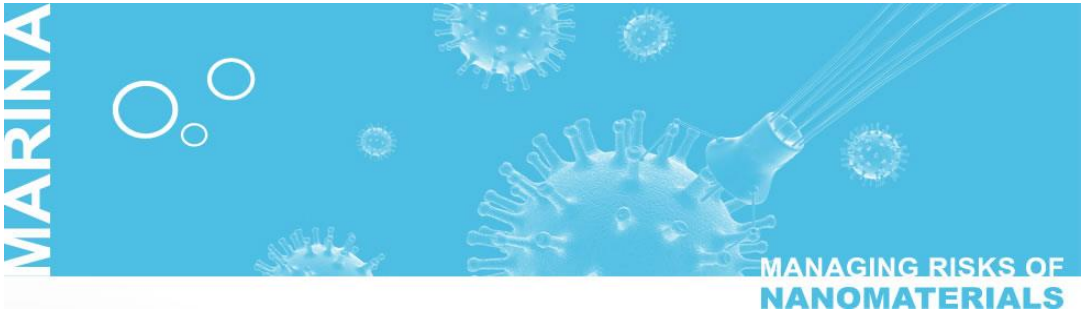
Framework of release



Conclusions

- **Release is the pre-requisite for exposure and can occur during different stages of the life cycle of ENM**
- **Different processes and simulation methods exist to determine release for specific materials/settings**
- **A framework is needed and presented here to allow for systematic and coherent information gathering**
- **The framework facilitates grouping of materials and different processes in view of their release potential, thus enabling read-across to minimize testing needs and facilitate safety of ENM**

Acknowledgements



Thank you for your attention

BUONAPARTE

SEVENTH FRAMEWORK
PROGRAMME