WHAT SAFE(R) BY DESIGN MEANS WHEN WE TALK ABOUT NANOMATERIALS (NMs)?

WHAT ARE NANOMATERIALS?

Nanomaterials are 1 **million** times **smaller** than a **hair**

In the form of a **particle, tube** or **sheet,** with a dimension between **1-100 nm**

For an equivalent mass, the **smaller** the particle **size**, the **larger** the **specific surface** area

AMAZING PROPERTIES!

At the **nanometric scale** nanomaterials may have **novel properties**:

Electrical properties

Magnetic properties

Chemical properties

Optical properties

SEVERAL FEATURES

These properties may cause nanomaterials to:

attach and transport pollutants

limit the use of material and energy ressources

penetrate into cells

provoke oxidative stress

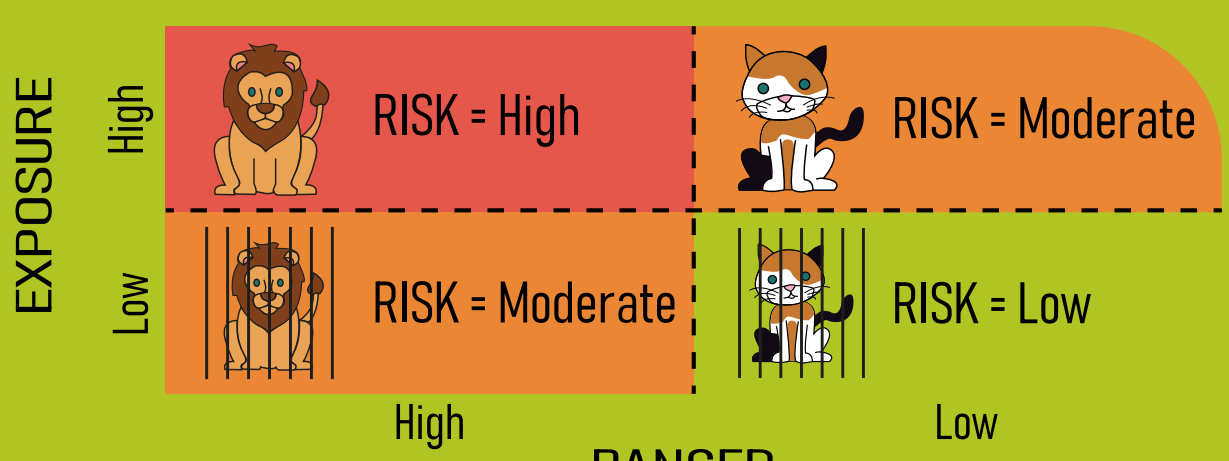
be explosive

☐ All these features can be **either benefitial or detrimental**, depending on the **application**.

☐ For **each case study,** experiments tend toward:

Limiting risk **Increasing Benefit**

RISK = DANGER x EXPOSURE



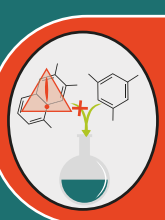
SERENADE CASE STUDIES FOCUS ON RISK DIAGNOSIS...

ANALYSING THE RISK OF NANOMATERIALS

Testing the toxicity and the exposure of nanomaterials for human beings, animals and the environment.

...AND RISK REDUCTION THROUGH

DANGER REDUCTION



SUBSTITUTING THE TOXIC SUBSTANCE

Replacing a toxic molecule whith a less toxic one while maintaining the same functionnalities.

AND EXPOSURE REDUCTION

IMMOBILIZING NANOMATERIALS

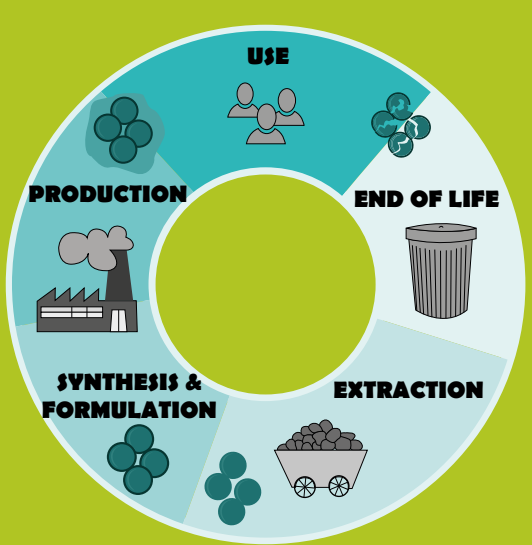
Embeding them on a matrix to control the release.

ENCAPSULATING AND COATING THE NANOMATERIAL

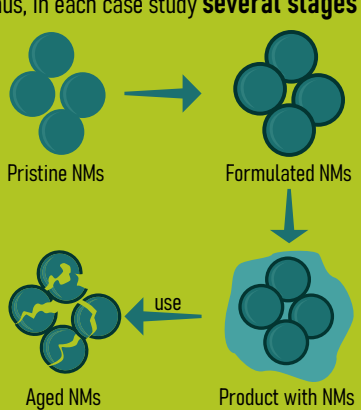
Encapsulating or coating the nanomaterial to target and control its reactivity.

Within the SERENADE project, each case study applied **one or more of these strategies** to optimize everyday products : sunscreeen, quantum dots, paints...

THESE STRATEGIES ARE APPLIED ALONG THE ENTIRE PRODUCT LIFE CYCLE



SERENADE does not focus only on the design phase, but addresses nanosafety during the **entire life cycle of nanoproducts,** from pristine to degradation residues.
Thus, in each case study **several stages** of this life cycle **will be considered.**



Pristine NMs are formulated (here coated), then introduced in the product. Finally, they are degraded during use to become **degradation residues.**

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