



Integrated Approaches to Testing and Assessment (IATA) for MXenes and advanced carbon nanomaterials

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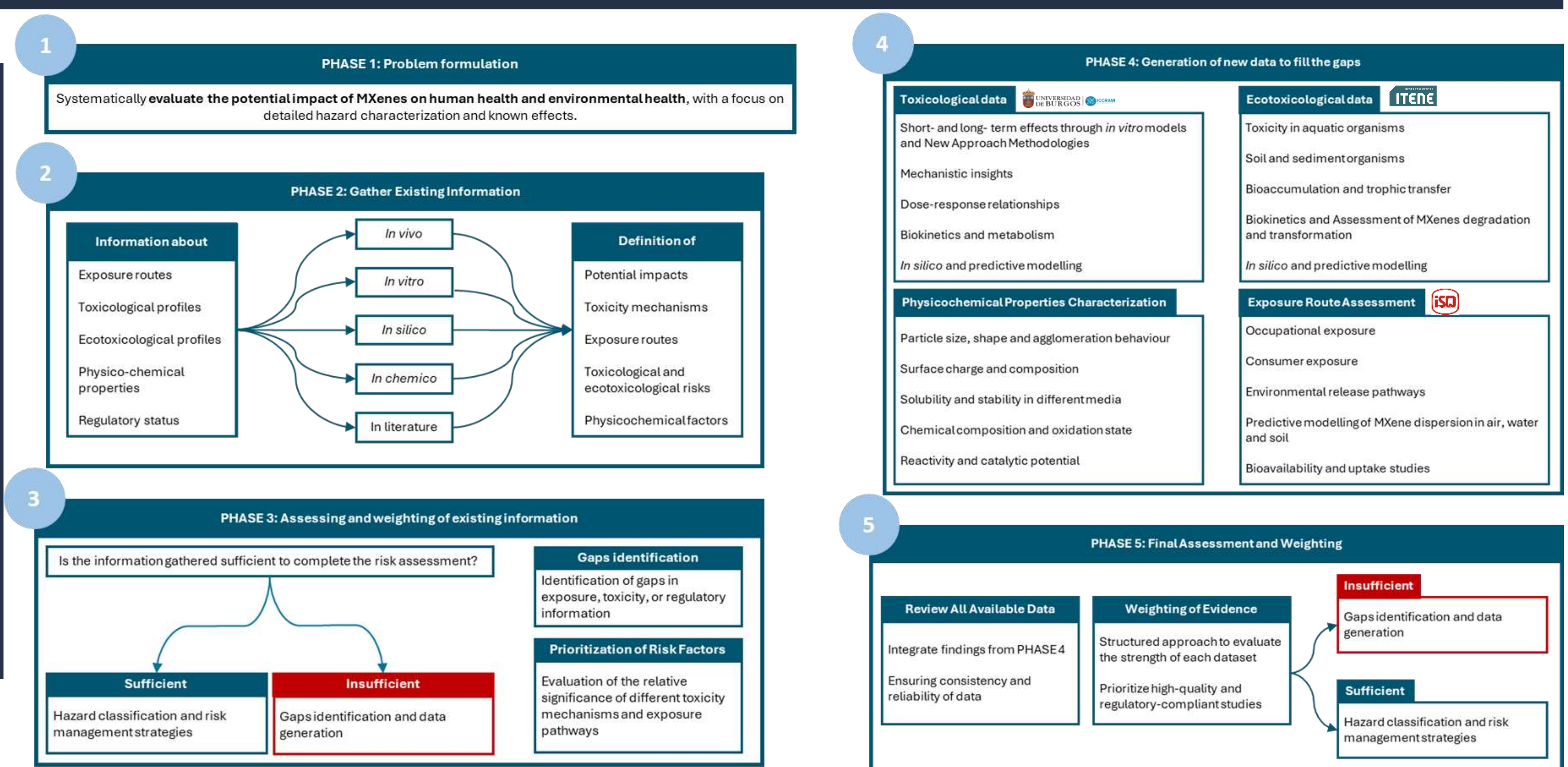
THIS STUDY AND METHODOLOGY

MXenes are **two-dimensional (2D) nanomaterials** made of transition metal carbides, nitrides, or carbonitrides, derived from MAX phases, which are layered ceramics with alternating layers of transition metals, carbon or nitrogen, and another element like aluminum or silicon. By selectively etching the 'A' element (typically aluminum) from MAX phases, **ultra-thin, flexible MXene nanosheets are created**. These sheets have **high surface area, excellent electrical conductivity, and tunable surface chemistry**, allowing modification through various functional groups.

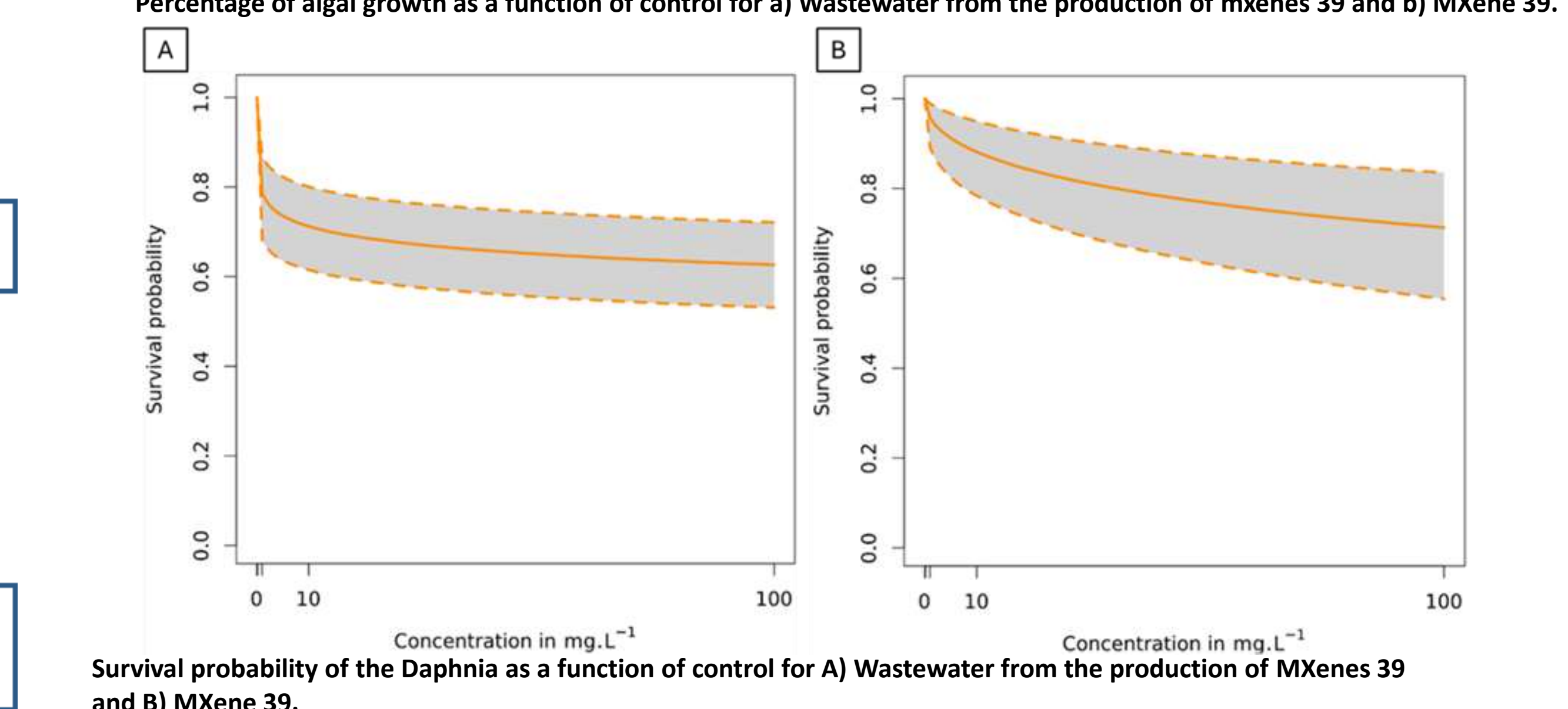
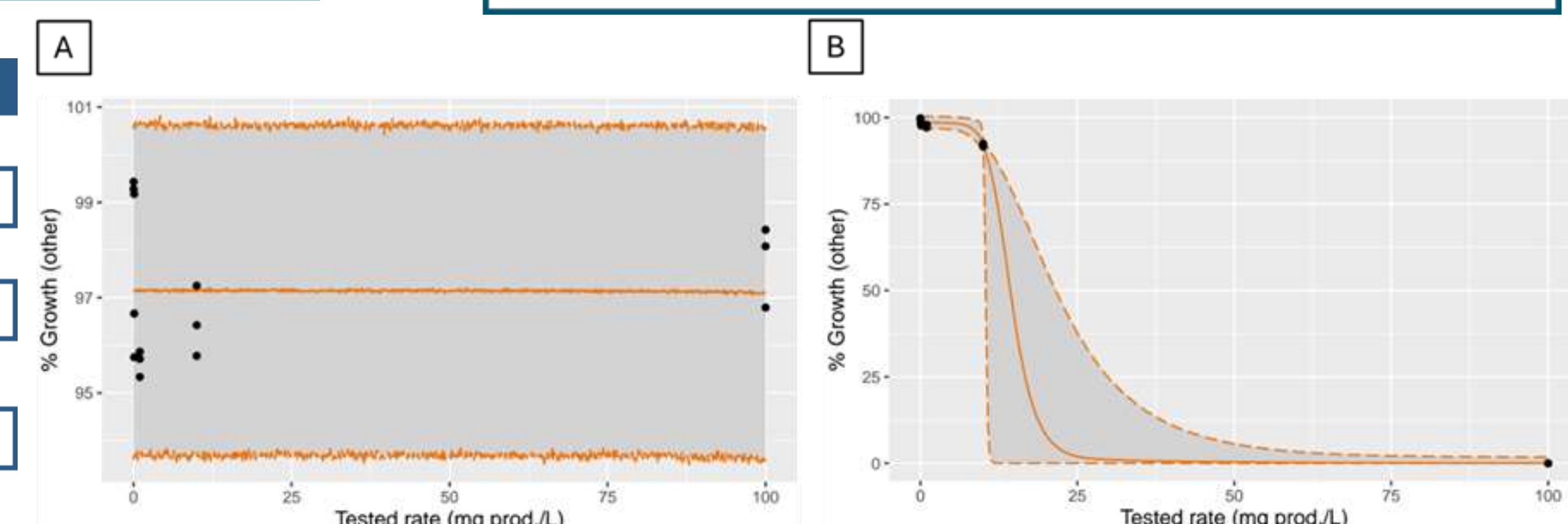
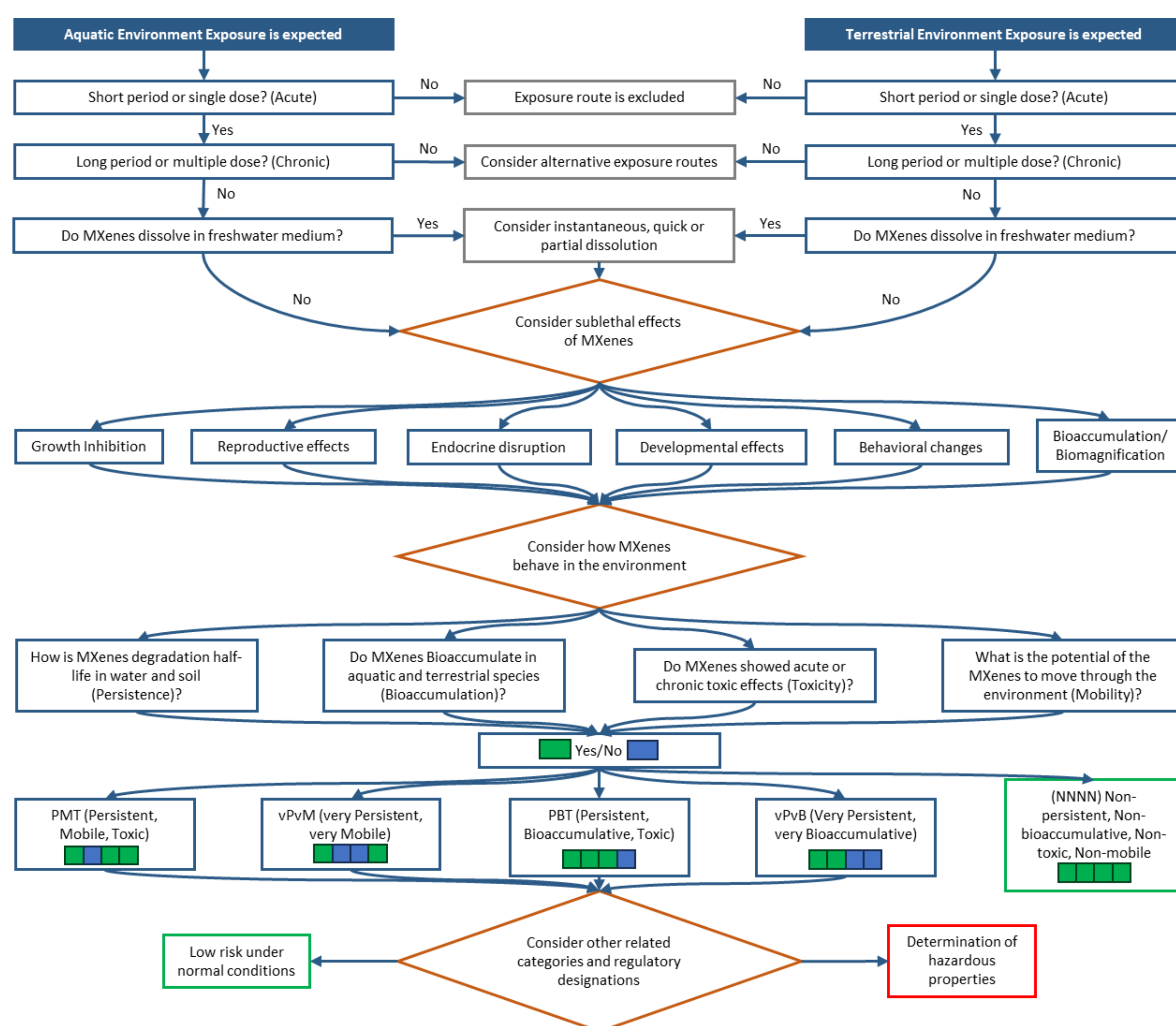


In the **SAFARI project**, MXenes are being developed for industrial applications in **conductive inks, glucose/lactate biosensors, and EMI shielding paints**, all aligned with the European Commission's **Safe and Sustainable by Design (SSbD) Framework**.

The **SAFARI project** is developing an **Integrated Approach to Testing and Assessment (IATA)** to evaluate the risks and hazards of both MXenes and their precursor MAX phases. This approach combines *in silico* tools, in chemico studies, and *in vitro* methods, using **New Approach Methodologies (NAMs)** to assess the safety of these nanomaterials. The goal of the IATA is to create a roadmap for evaluating the potential environmental and health impacts of MXenes, ensuring their safety and sustainability.



ECOTOXICOLOGICAL STUDIES



Conclusions

- Essential for Hazard Prioritization
- Support Ethical and Efficient Testing
- Address Unique properties of Advanced Materials
- Facilitate Regulatory Decision-Making
- Enable Integrated, Future-Ready Assessment

ACKNOWLEDGEMENTS



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SAFARI PROJECT



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