**CEFIC Long-range Research Initiative**

**Request for Proposals (RfP)**

***Title and Code Number:***

**Development of generic multimedia modelling framework for Microplastics in the environment** / **LRI-ECO56**

***Background***

Microplastics (MP) have received increased attention in scientific, regulatory, and social forums in recent years. This has resulted in the development of data on hazard and fate that is difficult to understand within a risk context. Therefore, proposals are requested to develop a general purpose multimedia modelling framework to understand the fate of MP in the environment, so that predicted environmental concentrations could be compared to appropriate risk thresholds. The objective is to produce a user-friendly tool that will be analogous to common chemical risk assessment tools such as EUSES [[1](#_ENREF_1)], RAIDAR [[2](#_ENREF_2)], Simplebox [[3](#_ENREF_3)], etc.

The modelling framework will be used to integrate and interpret existing data so that the MP risk assessment can be updated as new results are available. Further, the modelling framework will provide a basis for sensitivity analyses to evaluate certain processes and assumptions. Also, the modelling framework will be used to identify knowledge gaps for further research. It is expected that this framework will be open source, and available to the research community. Since the field of MP research is relatively new, the model framework should be flexible and allow for new processes to be included at later stages.

It is recognized that there are already published modelling efforts available [[4-8](#_ENREF_4)] and (CEFIC LRI ECO48 [link](http://cefic-lri.org/projects/eco48-nano2plast-extending-nanoparticle-models-to-open-source-models-of-the-fate-and-transport-of-microplastic-in-aquatic-systems/)) that are developed for similar reasons. The project that is requested here is to choose an appropriate framework and to develop a user-friendly interface so that non-expert users may run calculations to support decision making. For example, default parameters are provided for normal use, but could be replaced with other values as needed. The framework must also be modular so that new features, processes, or parameterizations could be implemented by CEFIC, the research team, or third party providers depending on the nature of the work. The application of effect thresholds is required to support risk assessments, but it is recognised that the state of science is evolving in this space.

The modelling framework must be based on a Regional scale Unit World concept [[9](#_ENREF_9)], which is a simple representation of the environment that includes basic landscape features, such as typical parameters for soil, agricultural soil, river, lake and coastal marine environments are represented.[[1]](#footnote-2) The model should allow for different but relevant microplastics properties (e.g. size, density, shape, etc.) to be evaluated, either separately or in unison. Processes such as fouling and aggregation need to be represented to assist with the understanding of fate and transport of micro and nanoplastics. In order to provide a frame of reference, fate and transport properties of other natural (clay) or synthetic particles (e.g., fibers) may be needed.

It is also emphasized that the state of science around environmental risk assessment of microplastics is evolving. And the research team should provide additional direction, or recommendations when appropriate to help meet the primary objectives of this project: Development of generic multimedia risk assessment model for microplastics in the environment.

***Objectives***

This project is looking to develop a generic multimedia risk assessment model for microplastics in the environment that will provide direction to planned and ongoing research and to provide relative and quantitative risk context to those study data.

The project’s objectives:

1. Equilibrium model of Regional Unit World
2. User friendly interface
3. Modular system to allow for addition of new features as state of science evolves
4. Provide default parameters for key processes, but allow use of alternate data
5. To develop a list of recommendations for experimental work to refine processes and model parameters
6. Framework must include ability to evaluate fate, transport, and stability of different classes of microplastic particles (e.g. size, density, shape, etc.)
7. User guidance document and reporting guidance document
8. Framework must be evaluated with existing exposure data for general proof of concept

***Scope***

Develop user-friendly regional scale steady state multimedia model to support risk-based decision making related to microplastics in the environment. User-friendly means the model should allow non-model experts to perform modelling analyses using default, or user-defined parameters. The specific choice of modelling platform is left to the research team but it should be accessible to the research community, and should allow for updates as key processes are further characterized in the future. All types of microplastics are in scope. The RfP is not restricted to certain type of microplastics e.g. polyolefin origin.

***Out of scope***

Site-specific and time variable calculations are interesting but are too specific for general purpose. The steady state approach is expected to provide realistic worst case characterization of exposure, and can be used to evaluate the relative impact of various processes, and site-specific data relative to other studies.

***Deliverables***

Working model

User’s manual

Presentation

Draft Manuscript

Open source code

***Cost and Timing***

Start in Q3’2021, duration 24 months

Budget in the order of €250K

***Partnering / Co-funding***

Applicants should provide an indication of additional partners and funding opportunities that can be appropriately leveraged as part of their proposal. Partners can include, but are not limited to industry, government/regulatory organizations, research institutes, etc. Statements from potential partners should be included in the proposal package.

***Fit with LRI objectives / Possible regulatory and policy impact involvements / Dissemination***

Applicants should provide information on the fit of their proposal with LRI objectives and an indication on how and where they could play a role in the regulatory and policy areas. Dissemination plans should also be laid down.

**DEADLINE FOR SUBMISSIONS: June 30th 2021**

***References***

1. Vermeire T, Jager D, Bussian B, Devillers J, Den Haan K, Hansen B, Lundberg I, Niessen H, Robertson S, Tyle H. 1997. European union system for the evaluation of substances (EUSES). Principles and structure. *Chemosphere* 34:1823-1836.

2. Arnot JA, Mackay D, Webster E, Southwood JM. 2006. Screening level risk assessment model for chemical fate and effects in the environment. *Environmental science & technology* 40:2316-2323.

3. Hollander A, Schoorl M, van de Meent D. 2016. SimpleBox 4.0: Improving the model while keeping it simple…. *Chemosphere* 148:99-107.

4. Meesters JAJ, Quik JTK, Koelmans AA, Hendriks AJ, van de Meent D. 2016. Multimedia environmental fate and speciation of engineered nanoparticles: a probabilistic modeling approach. *Environmental Science: Nano* 3:715-727.

5. Lamon L, Asturiol D, Vilchez A, Ruperez-Illescas R, Cabellos J, Richarz A, Worth A. 2019. Computational models for the assessment of manufactured nanomaterials: Development of model reporting standards and mapping of the model landscape. *Computational Toxicology* 9:143-151.

6. Liu HH, Bilal M, Lazareva A, Keller A, Cohen Y. 2015. Simulation tool for assessing the release and environmental distribution of nanomaterials. *Beilstein journal of nanotechnology* 6:938-951.

7. Besseling E, Quik JT, Sun M, Koelmans AA. 2017. Fate of nano-and microplastic in freshwater systems: A modeling study. *Environmental pollution* 220:540-548.

8. Siegfried M, Koelmans AA, Besseling E, Kroeze C. 2017. Export of microplastics from land to sea. A modelling approach. *Water Research* 127:249-257.

9. Harvey C, Mackay D, Webster E. 2007. Can the unit world model concept be applied to hazard assessment of both organic chemicals and metal ions? *Environmental Toxicology and Chemistry: An International Journal* 26:2129-2142.

1. Some basic functionality on exposures (e.g., bioaccumulation processes, or associated MP dust with the food basket) to humans via the environment are needed, but it is recognised that much of the exposure may also occur through handling, transportation, and preparation of the food basket items. This topic should be taken up in a future project but it is out of scope for the moment. [↑](#footnote-ref-2)