**CEFIC Long-range Research Initiative**

**Request for Proposals (RfP)**

***Title and Code Number***

Working towards better understanding of hypothesized long-range transport of plastic additives facilitated by microplastics – Building models to support quantitative and use specific understanding / **LRI-ECO 57**

***Background***

Atmospheric transboundary and intercontinental Long-Range Transport (LRT) of chemicals may influence air quality and contamination of areas far from the initial emission. Those chemicals transported long distance may have an impact on human health as well as on the environment in locations remote from the emission sources. The need for coordinated actions among countries has been recognized and international cooperation was put in place through several agreements to combat the impact of such pollutants (United Nations Environment Programme’s (UNEP) Stockholm Convention on Persistent Organic Pollutants).

Early on, a publication by Mackay et al. (2001) drew attention to the importance of intensive (e.g. solubility in water) versus extensive properties (e.g. amount of chemical present or enthalpy) chemicals when evaluating persistence and long-range transport potential. Consequently, the concentration of a chemical in the environment represents an extensive property. This can be influenced by a variety of factors including the interactions between the intensive properties of the chemical and several external environmental variables, such as emission rate, environmental volume ratios of organic carbon, air and water, temperature and variability in hydrological and meteorological dynamics.

The potential for a chemical to undergo long-range transport results from its partitioning tendency into mobile media, such as into air and water, the velocity of these media, and a quasi-intensive potential to be persistent. The distance a substance travels in this instance is independent of the quantity released, implying that long-range transport in this context can be characterized as a quasi-intensive property. Following Mackay et al. (2001), chemicals that strongly sorb to particles or are incorporated into the matrix and are transported via particle-bound transport need to be considered differently than persistent chemicals with strong tendency to partition into the aqueous phase or volatile persistent chemicals. They can only be evaluated by quantifying the mass of particles and the mass of chemical that is subject to mobility. Thus, particle-bound or more even particle incorporated transport represents an extensive property of a chemical, subject to episodic variability of processes in the external environment.

Recent discussion regarding the environmental fate and potential global transport of plastic debris, particularly in the form of microplastic particles (MPs), has raised attention regarding the relevance of these materials to facilitate the transport of particle-incorporated chemicals. In their assessment related to the role that plastic may play as vector of transport for POPs (adsorbed to plastic particles) to biological organisms ingesting contaminated plastic, Gouin et al. (2011), Koelmans et al. (2013) and Bakir et al. (2016) all use multimedia models to assess the relative importance of this exposure pathway. The use of models in this context is particularly beneficial, as there exists significant challenges to differentiate between exposure to a chemical via plastic relative to exposure from other pathways, such as inhalation and ingestion. However, there is a model and a tool missing that describes hypothesized potential of microplastics for long range transport and matrix incorporated additives, especially when it comes to comparison to other sources of exposure.

***Objectives***

During the past meeting of the Persistence Organic Pollutants Review Committee meeting in January 2021, the members discussed of hypothesized long-range transport of plastic additives facilitated by microplastics. The hypothesis was made whether a substance incorporated to plastic debris would qualify for long range transport potential. An intersessional working group was established to further elaborate on the science behind this hypothesis. The suggested research should contribute to this effort in providing further and better understanding on this topic.

The project’s objectives are to:

1. Provide a good understanding of the state of the art in understanding the potential of particulates in general and with a focus on microplastics for long range transport. Identify and document existing models to describe long-range transport of particulates and microplastics in particular. Compare the capabilities of the models compared to the existing science for understanding long range transport of microplastics.
2. Dependent on the findings in step 1, further develop an existing model or newly develop a multi-media transportation model for hypothesized long-range transport of microplastics though air and water that considers recent developments in science. This model needs to cover the diversity of microplastics (e.g. size, shape, matrix, density) in a flexible and parametrizable manner. It also needs to be capable of quantifying the transport.
3. Integrate the long-range transport model for microplastics into existing models and frameworks for substances potential for long-range transport.
	1. Provide the ability to evaluate the hypothesized potential for long-range transport for additives[[1]](#footnote-1) incorporated into the plastic matrix. Therefore, readily provide the functionality to integrate the output on modelled environmentally relevant leachability of plastics additives (see cefic LRi on leaching) into the LRT model on microplastics.
	2. Provide the ability to differentiate and to compare (based on existing models and assumptions) a substance’s hypothesized capability for LRT as additive in a microplastics matrix compared to other pathways for LRT (including transport associated to adsorption on natural occurring particles, non-particle associated LRT potential via air and water).
4. The work in item 2 needs to provide the opportunity to identify and quantify use specific contribution to hypothesized long-range transport potential of the microplastics.

***Scope***

Hypothesized long-range transport potential of microplastics through water and air is in focus and scope of this RfP. All types of microplastics are in scope. The RfP is not restricted to certain type of microplastics e.g. polyolefin origin. Vector effects for substances incorporated into the microplastics matrix are in scope.

***Out of scope***

Particles other than microplastics are not in main focus of this RfP but could be explored in the context of providing comparison with microplastics. Vector effects for POPs already in the environment are out of scope.*Also,* the development of a model on environmentally relevant leachability/bioavailability of additives in plastics is not in scope of this proposal. This is subject to another Cefic LRI RfP. However, once results from the other Cefic LRI become available, it should be easily incorporated and interlinked into the proposed LRT work.

***Deliverables***

The final report shall contain an executive summary (2 pages max.), a main body of text (50 pages max.) and a detailed bibliography.

It is expected that the findings will be developed into at least one peer-reviewed publication, following poster and oral presentation(s) at suitable scientific conference(s). At least one publication shall be open access. The computational model shall be provided open source including documentation. Dissemination of the results during a workshop with globally recognized scientist and regulatory bodies in the field would be welcomed.

***Cost and Timing***

Start in Q3 2021, duration 24 months

Budget in the order of €300K

***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 of study results should also be outlined.

***Reference***

Bakir A, O'Connor IA, Rowland SJ, Hendriks AJ, Thompson RC (2016), Relative importance of microplastics as a pathway for the transfer of hydrophobic organic chemicals to marine life. Environ Pollut. 219:56-65.

Gouin T, Roche N, Lohmann R, Hodges G. (2011), A thermodynamic approach for assessing the environmental exposure of chemicals absorbed to microplastic. Environ Sci Technol. 45(4):1466-72.

Koelmans AA, Besseling E, Wegner A, Foekema EM (2013), Plastic as a carrier of POPs to aquatic organisms: a model analysis. Environ Sci Technol. 47(14):7812-20.

Mackay, D., McCarty, L.S. and MacLeod, M. (2001), On the validity of classifying chemicals for persistence, bioaccumulation, toxicity, and potential for long‐range transport. Environmental Toxicology and Chemistry, 20: 1491-1498. <https://doi.org/10.1002/etc.5620200711>

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

**Please see** [**www.cefic-lri.org/funding-opportunities/apply-for-a-grant/**](http://www.cefic-lri.org/funding-opportunities/apply-for-a-grant/) **for general LRI objectives information, project proposal form and further guidance for grant application**

1. Additives include chemicals that are absorbed in the matrix (e.g. phthalates), encapsulated in the polymer, or applied as blending of the polymer resulting in a coating. [↑](#footnote-ref-1)