World Coatings Council Addresses Microplastics in Marine Environments

The contribution of paint to microplastics pollution – small pieces of plastic, less than 5 mm in size – and their potential impact on the environment and human health have been the subject of numerous studies and reports in recent years. While the reports differ in their scope, there is no real data or science-based, peer-reviewed study that can conclusively quantify the contribution of paint to microplastics pollution in the marine or terrestrial environment. However, constructive action to address the issue requires the use of estimates based on the best available assumptions. WCC and its members are open to share and collaborate in the continuous improvement of said assumptions to yield the most useful estimates of the industry's participation in the issue.

The Industry's Conducted a Literature Search Focused on Reports and Studies That Embraced Sound Scientific Principles, Rather than Assumptions based on Minimal Factual Basis

As WCC's Secretariat, the American Coatings Association (ACA), completed a literature search[1] to understand the state of the science and available data on microplastics generated by paints and coatings. The literature search identified and analyzed 36 key documents, to produce a summary of the current scientific state of knowledge on coatings-related microplastics regarding: physical and chemical properties, environmental fate and transport, claimed human or ecological impacts, estimated environmental inputs, and regulatory initiatives and published regulations. The Environmental Action report[2] was intentionally added to the study because its being cited by regulatory authorities in the EU despite the lack of scientific rigor used estimating the percentage of microplastics presumably associated with paints and coatings. In its analysis of paint and coatings-related microplastics studies, the report was very clear that sound data on the contribution of microplastics made by the coatings industry does not currently exist and the studies in circulation use a wide range of assumptions.

The ACA literature search focused on documents such as academic review papers and government agency reports, as well as primary literature studies such as peer-reviewed publications. The 36 documents chosen for the literature review: 2 peer-reviewed publications, 10 scientific review papers, and 24 secondary source documents, taken together, best represent the state of science on coatings-related microplastics

It is critical that conclusions in publication and discussion apportioning responsibility on any industry, be based on scientifically substantiated data and rigorous real-world study. In the absence of such data, estimates based on the best available assumptions can be used if the assumptions remain open to continuous improvement as relevant data becomes available. Moreover, any effort to quantify the potential release of microplastics from products must also consider all known mitigating factors. Legitimate questions of the published articles and studies demonstrate problematic assumptions and conclusions about the role of microplastics from paints and coatings in marine environments.

The World Coatings Council seeks to apply sound scientific principles to studying how coatings may contribute to microplastics pollution by conducting studies based upon reliable data and utilizing, where necessary, assumptions based upon real world applications. More accurate assumptions could lead to more accurate data on the contribution of the paints and coatings industry to the presence of microplastics in the environment and allow the industry to continue to address this issue appropriately.

---

[1] Gradient. "Literature Review of Coatings-Related Microplastics" 2022. American Coatings Association.
[2] Paruta, P; Pucino, M; Boucher, J. 2022. "Plastic Paints the Environment: A Global Assessment of Paint's Contribution to Plastic Leakage to Land Ocean & Waterways." EA – Environmental Action.

Scientific Substantiation is Necessary

Almost all of the key documents and studies reviewed in the industry's literature search referenced above indicate that there is no real data quantifying the contribution of paint to microplastics pollution. Many of these reports, however, employ a range of assumptions regarding degradation rates and removal practices in order to estimate the contribution of paint. With the exception of one report[3], the range of paint's contribution to microplastics pollution is estimated to be between 9.6% and 21%. A recent publication issued in 2022 by the U.S.-based NGO, Environmental Action, indicates that paint contributes 58% of the plastic pollution. The report suggests that paint is the largest source of microplastics leakage to the ocean and waterways, outweighing all other sources such as tire dust and textiles. This report uses a methodology to map, measure and forecast plastic leakage along the value chain. The authors of the report note that their estimate differs from a majority of previous reports due to their assumptions which include different wear and tear and removal rates than all other studies. CEPE, the European Paint Association, has written to the European Commission to explain the many flaws in the assumptions made in the EA report, which the authors themselves admit is an outlier in terms of its conclusions in positioning the size of the impact of paint compared to other sources of microplastics.

Results of the Literature Review conducted by World Coatings Council member ACA make clear that there is limited knowledge on source, environmental contribution, environmental and human health risks, and wastewater from paint-related microplastics. The following points address those limitations and underscore the need for data-driven, quantitative research on microplastics.

<u>Sound Science Related to Coatings and Microplastics:</u>

- There is consensus in the current scientific literature that there is **insufficient evidence to assess the risk of primary microplastics — coatings-related or otherwise — to human health**. The lack of evidence has been attributed to difficulties in quantifying human exposures and the inability to associate any observed effects to primary microplastics exposure per se, as opposed to co-exposures to chemicals that may be associated with the microplastic particles. Key factors that limit the current understanding of potential ecological and human health impacts of microplastics (coatings-related or otherwise) are the diversity of microparticles with respect to physical and chemical characteristics (*e.g.*, size, density, chemical composition) and a lack of consensus on methods for quantifying their concentration and migration in the environment. Notably, **risk assessments conducted by international scientific agencies (albeit based on limited data) have suggested that human exposures to microplastics, or chemicals associated with microplastics, are likely at a low level of health concern[4][5].**

- **Estimates of coating-derived microplastic particles entering the environment rely on assumptions concerning weathering or transport phenomena in addition to estimates of paint usage volumes, as well as extrapolation of findings from small-scale tests.** The lack of quantitative measurements regarding degradation and emission of microplastics (coatings-related

[3] Paruta, P; Pucino, M; Boucher, J. 2022. "Plastic Paints the Environment: A Global Assessment of Paint's Contribution to Plastic Leakage to Land Ocean & Waterways." EA – Environmental Action.
[4] Lusher, AL; Pettersen, R. 2021. "Sea-Based Sources of Microplastics to the Norwegian Marine Environment." Norwegian Institute for Water Research (NIVA). Report to the Norwegian Environment Agency. Report No. 7568-2021, 106p
[5] World Health Organization, 2019. Microplastics in drinking-water. Geneva. License: CC BY-NC-SA 3.0 IGO. Available from: https://www.who.int/water_sanitation_health/publications/microplastics-in-drinking-water/en/.

or otherwise) into the environment are identified as major data gaps[6][7][8] recently estimated environmental inputs of microplastics in paint and concluded[9]:

> "This study has been performed in a data-scarce context, as loss rates are poorly documented both in the scientific or grey literature. The intention of the report is therefore not to provide a precise assessment, but rather to estimate the order of magnitude of paint leakage, in order to determine if paint makes a significant contribution to the total plastic leakage. To navigate this data-scarce environment, expert assumptions have been used for some of the model parameters, always with a range of uncertainty provided, and serving as a basis for feeding the Monte Carlo analysis and deriving results within a reliable range of probability."

- **Microplastics (coatings-related or otherwise) are removed during wastewater treatment with an efficiency dependent on the treatment methods applied.** Conventional wastewater treatment methods (*e.g*., sedimentation and dissolved air flotation processes applied as primary treatments) are effective at reducing emissions of microplastics (coatings-related or otherwise) Notably, secondary treatment (*i.e*., use of coagulants and generation of sludge) has been shown to decrease microplastic content in water effluent, although it remains in secondary sludge. Tertiary treatments have been identified as highly effective at removing microplastics (coatings-related or otherwise), with up to 99% of microplastics being filtered out from wastewater effluent through use of membrane bioreactors, disk filters, sand filtration, and membrane microfiltration[10].

- Paint particles in general, including antifouling marine paints, contain film-formers based on organic polymers that are the paint ingredients that may (depending on the definition of "plastics") contribute to a paint fragment being defined as microplastics. Typical film-formers in antifouling marine paints are combinations of acrylic and/or silyl polymers, possibly in combination with rosin (colophony). "Plastic-like" paint particles will be denser and more heterogenous, angular, and brittle than typical microplastics[11]. Also, **since the film former is organic and designed to dissolve in seawater, anti-fouling paint particles are likely to be far more short-lived than other microplastics in the marine environment**.

---

[6] Galafassi, S; Nizzetto, L; Volta, P. 2019. "Plastic sources: A survey across scientific and grey literature for their inventory and relative contribution to microplastics pollution in natural environments, with an emphasis on surface water." Sci. Total Environ. 693:133499. doi: 10.1016/j.scitotenv.2019.07.305.

[7] Lusher, AL; Pettersen, R. 2021. "Sea-Based Sources of Microplastics to the Norwegian Marine Environment." Norwegian Institute for Water Research (NIVA). Report to the Norwegian Environment Agency. Report No. 7568-2021, 106p

[8] Turner, A. 2021. "Paint particles in the marine environment: An overlooked component of microplastics." Water Res. X 12:100110. doi: 10.1016/j.wroa.2021.100110.

[9] Paruta, P; Pucino, M; Boucher, J. 2022. "Plastic Paints the Environment: A Global Assessment of Paint's Contribution to Plastic Leakage to Land Ocean & Waterways." EA – Environmental Action.

[10] Talvitie, J; Mikola, A; Setälä, O; Heinonen, M; Koistinen, A; "How well is microlitter purified from wastewater? – A detailed study on the stepwise removal of microlitter in a tertiary level wastewater treatment plant." Water Research, Volume 109, 2017, Pages 164-172, ISSN 0043-1354, doi: doi.org/10.1016/j.watres.2016.11.046.

[11] Turner, A. 2021. "Paint particles in the marine environment: An overlooked component of microplastics." Water Res. X 12:100110. doi: 10.1016/j.wroa.2021.100110.

Lack of Data:

- Across these studies, **no quantitative measurements of coatings-related microplastics emissions were identified**. The consensus among the literature is that data is lacking (due in part to lack of agreement on measurement approaches) to quantify the relative environmental contribution of coatings-related microplastics *vs*. microplastics in general, and many uncertainties remain. Specifically, this applies to the unsubstantiated identified sources of microplastics: antifouling paints, road marking paints, and abrasive blasting of coatings. **The research demonstrates no quantitative determination of microplastics emissions from these named sources; rather, conclusions are drawn based on assumptions regarding disposal, longevity, rates of removal, retention, and usage.**

- **Research that has focused specifically on paints and coatings as sources of microplastics is still relatively limited**. For example, in 2019, the International Maritime Organization conducted a literature review to identify data regarding marine coatings as microplastics sources (IMO, 2019). In this report, the IMO concluded:

  > "[A]part from minimal comments in researched literature that the loss of plastics from AFS [antifouling systems] may be an issue (*e.g*., Lassen *et al*., 2015; Boucher and Friot, 2017; Eunomia, 2018), direct research on this possibility was not readily apparent. This review, as well as personal communications with an expert in this field, did not readily reveal any research directly investigating microplastics from anti-fouling systems and/or marine coatings, though this may be available, but as yet unpublished or accessible." (IMO, 2019)

- The **long-term environmental impacts of antifouling paint particles are a current data gap. Potential environmental impacts of other coating-related microplastics are also a data gap**. While the presence of coatings-related microplastics has been demonstrated in the terrestrial (e.g., road dust) and aquatic environments, the only studies evaluating potential environmental impacts of coatings-related plastics are those associated with antifouling paints. Notably, most of these studies examined short-term toxicity. **More conclusive studies are necessary**.

Best Practices to Prevent Releases:

- When coating any surface, including ships with antifouling paints, the goal is to get the coating onto the intended surface as efficiently as possible. Good practice at application will minimize any release of paint droplets to the environment (overspray). **Training applicators on effective application techniques and the use of efficient spray equipment that delivers wet paint to the target with minimal overspray is essential. Therefore, the World Coatings Council cannot overemphasize the importance of this recommendation. There is clear business and environmental value in minimizing lost paint and coating companies and applicators actively work to reduce any loss through overspray[12].**

[12] International Maritime Organization. Guidance on best management practices for removal of anti-fouling coatings from ships, including TBT hull paints. International Convention on the Control of Harmful Anti-fouling Systems on Ship, 2001. July 22, 2009. Retrieved from: file:///Users/kberry/Downloads/AFS.3-Circ.3.pdf

- **During coating removal, current best management practices minimize the potential for the release of material.** This has been advised and implemented for removal of antifouling coatings for over 10 years, via the (AFS.3/Circ.3) IMO guidance, which the World Coatings Council and its members have actively supported and encouraged. Good "dry-dock discipline" and 'good marina discipline' in the case of leisure boats is highly effective in ensuring waste from ship/boat maintenance and repair activity is appropriately collected and disposed of appropriately. In marine harbors, residues from boat hull preparation are controlled and restricted including the physical capture of the debris.

- Antifouling coatings are among the most regulated coatings around the world. Before being authorized for sale, antifouling coatings must comply with registration requirements that often include a **strict risk assessment process to demonstrate that they do not cause an unacceptable risk to the environment.** These procedures are fundamental to the legal supply of commercial products sold, in accordance with Chemical Management laws globally and Biocide/Pesticide laws directly controlling antifouling coatings where they are in force.

- **Antifouling coatings play a key role in protecting the world's climate and oceans by reducing greenhouse gas emissions from shipping and the translocation of invasive species across oceans**. Marine coatings manufacturers, the ocean transport industry and World Coatings Council members continue to invest in technologies and approaches that reduce the environmental impact of these solutions wherever possible.

CEPE Leads Efforts to Replace Estimates and Assumptions with Data and Sound Science

The European Council of the Paint, Printing Ink and Artists' Colours Industry (CEPE) is currently conducting two studies to understand release and degradation of microplastics from façade coatings and marine coatings. These two studies will enhance the industry's knowledge of coatings-related microplastics and provide data on the degradation rates of façade coatings.