Proposal to Add Microplastics to the Candidate Chemicals List

Virtual Public Workshop: June 27, 2023, from 9:00 AM to Noon, Pacific Standard Time

WHAT IS DTSC PROPOSING?

The Department of Toxic Substances Control's (DTSC's) Safer Consumer Products (SCP) Program is proposing to add microplastics (MPs) to its Candidate Chemicals List.

WHY IS DTSC CONSIDERING THIS ACTION?

There is growing concern over the potential adverse impacts of MPs released to the environment (Koelmans et al. 2019; Suaria et al. 2020; Wong et al. 2020; Brahney et al. 2021). MPs are ubiquitous in the environment, and both humans and animals are exposed to them. Further, there is an emerging body of evidence suggesting that these exposures may be harmful (Toussaint et al. 2019; Mohamed Nor et al. 2021; Coffin et al. 2022).

In its 2021-2023 Priority Product Work Plan, DTSC identified five special considerations for evaluating products, including the "potential for the product to release MPs to the environment during the use or end-of-life stages of the product's life cycle." DTSC is currently limited to considering MPs only if they are contained in products that are selected for evaluation because they contain other chemicals that are on the Candidate Chemicals List. Adding MPs to the Candidate Chemicals List would allow DTSC to evaluate products strictly because they contain MPs or may release MPs to the environment. This concept was presented to SCP's Green Ribbon Science Panel (GRSP) for consideration on November 5, 2021, and the panel generally expressed support.

DO MPs MEET THE DEFINITION OF A CHEMICAL?

Yes. Within the framework of the SCP Regulations, "chemical" is broadly defined as "an organic or inorganic substance of a particular molecular identity, including any combination of such substances occurring, in whole or in part, as a result of a chemical reaction or occurring in nature, and any element, ion or uncombined radical, and any degradate, metabolite, or reaction product of a substance with a particular molecular identity."[1] The regulations specify that "molecular identity" may be described in terms of a substance's particle size, size distribution, and surface area. DTSC is basing its proposed definition for MPs (see below) on the polymeric structure and size distribution (< 5,000 microns) of MPs.

[1] See Cal. Code Regs. tit. 22, section 69501.1(a)(20)(A)(1).

HOW DOES DTSC PROPOSE TO DEFINE "MPs"?

DTSC proposes the following definition for MPs:

"Microplastics" are defined as solid polymeric materials to which chemical additives or other substances may have been added, which are particles having at least three dimensions that are less than 5,000 micrometers (µm). Polymers derived in nature that have not been chemically modified (other than by hydrolysis) are excluded.

- "Solid" means a substance or mixture which does not meet the definitions of liquid or gas.
  - "Liquid" means a substance or mixture which (i) at 50 degrees Celsius (°C) has a vapor pressure less than or equal to 300 kPa; (ii) is not completely gaseous at 20 °C and at a standard pressure of 101.3 kPa; and (iii) which has a melting point or initial melting point of 20 °C or less at a standard pressure of 101.3 kPa.
  - "Gas" means a substance which (i) at 50 °C has a vapor pressure greater than 300 kPa (absolute); or (ii) is completely gaseous at 20 °C at a standard pressure of 101.3 kPa.
- "Polymeric material" means either (i) a particle of any composition with a continuous polymer surface coating of any thickness, or (ii) a particle of any composition with a polymer content of greater than or equal to 1% by mass.
- "Polymer" means a substance consisting of molecules characterized by the sequence of one or more types of monomer units. Such molecules must be distributed over a range of molecular weights wherein differences in the molecular weight are primarily attributable to differences in the number of monomer units. A polymer comprises the following: (a) a simple weight majority of molecules containing at least three monomer units which are covalently bound to at least one other monomer unit or other reactant; (b) less than a simple weight majority of molecules of the same molecular weight. 'Monomer unit' means the reacted form of a monomer substance in a polymer. 'Monomer' means a substance which is capable of forming covalent bonds with a sequence of additional like or unlike molecules under the conditions of the relevant polymer-forming reaction used for the particular process.
- "Particle" means a minute piece of matter with defined physical boundaries; a defined physical boundary is an interface.
- Size-based nomenclature within the dimension limits include: "nanoplastics" (1 nm to <100 nm); "sub-micron plastics" (100 nm to <1 µm); "small microplastics" (1 µm to < 100 µm); "large microplastics" (100 µm to <5 mm).

This proposed definition is consistent with the State Water Resources Control Board's [Definition of Microplastics in Drinking Water] (SWRCB Resolution No. 2020-0021).

DTSC recognizes that two forms of MPs contribute to environmental pollution: primary and secondary. Primary MPs, including but not limited to microbeads or nurdles, are manufactured and intentionally added to products. Secondary MPs arise from the environmental degradation of plastic products such as plastic bags or water bottles. The proposed definition does not distinguish between primary and secondary MPs. Therefore, both would be considered Candidate Chemicals if MPs are added to the Candidate Chemicals List.

WHAT ARE THE POTENTIAL HAZARD TRAITS AND/OR TOXICOLOGICAL AND ENVIRONMENTAL ENDPOINTS THAT ARE THE BASIS FOR THIS PROPOSED LISTING?

Environmental Persistence

The hazard trait of environmental persistence is defined as "the propensity for a chemical substance to remain in the environment for a long time period subsequent to its release by resisting chemical and biological degradation."[2]

Evidence for environmental persistence includes but is not limited to:

- The substance having been identified as persistent by an authoritative organization,
- Resistance to degradation in wastewater treatment processes,
- A half-life in marine, fresh or estuary water of greater than 40 to 60 days, in sediment of greater than 2 months, in ambient air of greater than 2 days, or in soil of greater than 2 months; and/or,
- Structural similarity to other persistent chemicals.

A recent study summarizing the environmental persistence of plastic reviewed six types of plastic polymers (Chamas et al. 2020). In the marine environment, estimated half-lives for five of the six materials ranged from 53 – 1,200 years (Chamas et al. 2020). When buried in terrestrial environments, half-lives for five of the six materials ranged from 250 – 5,000 years (Chamas et al. 2020). Only one material of the six tested, low density polyethylene, exhibited an estimated half-life of less than 5 years in terrestrial and marine environments (Chamas et al. 2020).

[2] See Cal. Code Regs. tit. 22, section 69405.3.

Differences in the physico-chemical properties of MPs compared to bulk plastic, and different degradation pathways, may lead to variation in MP persistence. Bulk plastic in the environment degrades into MPs, essentially creating a constant source of MPs (Chamas et al. 2020; MacLeod 2021). One study found that different types of MP materials persist in the environment up to 11 years (Zhu et al. 2020). A preponderance of reliable information strongly suggests that MPs are persistent in the environment.

Mobility in Environmental Media

"Mobility in environmental media" is a hazard trait that is defined as the capacity for rapid movement of a chemical substance in the environment.[3] Evidence for the environmental mobility of a chemical substance includes, but is not limited to:[4]

- Reports in the scientific literature of environmental mobility,
- Evidence of the widespread contamination of the food chain, or for global distribution, or ubiquitousness in the environment; and/or,
- Physicochemical characteristics predisposing to ease of movement through environmental compartments such as air, water, or soil.

MPs exhibit the mobility in environmental media hazard trait. They are readily carried on wind and water currents, and they are distributed globally (Hale et al. 2020; Suaria et al. 2020; MacLeod 2021; United Nations Environment Program 2021). They are found in surface waters, soil, air, oceans, deep ocean sediments, and on the tops of the highest mountain peaks.

WHAT RELIABLE INFORMATION DEMONSTRATES THE OCCURRENCE OR POTENTIAL OCCURRENCE OF EXPOSURES TO MPs AS THE BASIS FOR THE PROPOSED LISTING?

DTSC must consider potential exposures to the chemical based on:[5]

A. Reliable information regarding potential exposures to the chemical, and

B. Reliable information demonstrating the occurrence, or potential occurrence, of exposures to the chemical.

Reliable information is defined as a scientific study or other scientific information that meets the criteria in subparagraphs (A) and (B) below:

[3] See Cal. Code Regs. tit. 22, section 69405.6(a).
[4] See Cal. Code Regs. tit. 22, section 69405.6(b).
[5] See Cal. Code Regs. tit. 22, section 69502.2(b)(2).

(A) The study or other scientific information was:[6]

1. Published in a scientifically peer reviewed report or other literature,
2. Published in a report of the United States National Academie,.
3. Published in a report by an international, federal, state, or local agency that implements laws governing chemicals; and/or
4. Conducted, developed, submitted, prepared for, or reviewed and accepted by an international, federal, state, or local agency for compliance or other regulatory purposes.

(B) With respect to a scientific study, the study design was appropriate to the hypothesis being tested, and sufficient to support the proposition(s) for which the study is presented to the Department.[7]

Reliable Information Regarding Potential Exposures to MPs

Numerous reports show that MPs are widely distributed in aquatic and terrestrial ecosystems throughout the world and that humans and animals are exposed to MPs by a variety of routes, including ingestion, inhalation, and dermal routes (Duis and Coors 2016; Dris et al. 2017; Gasperi et al. 2018; Gasperi et al. 2018; Eerles-Medrano et al. 2019; Koelmans et al. 2019; Hale et al. 2020; Zhang et al. 2020; Kutralam-Muniasamy et al. 2020; Wong et al. 2020; MacLeod 2021; United Nations Environment Program 2021; Mohamed Nor et al. 2021; Soltani et al. 2021). Microplastics have even been detected in human placenta, and in infant and adult feces (Ragusa et al. 2021; Zhang et al. 2021). The references regarding potential exposures to MPs cited here are by no means exhaustive, and there is a vast volume of information available in the scientific literature showing that MP pollution is distributed throughout virtually every ecosystem on Earth. A recent report estimated that humans are exposed to MPs predominantly via diet and inhalation (Cox et al. 2019; Mohamed Nor et al. 2021; World Health Organization 2022). Thus, the SCP Program has determined that the vast volume of reliable information available regarding the global distribution and persistence of MPs in the environment, and the exposure of terrestrial and aquatic organisms to MPs, adequately demonstrates that there is a high potential for human and animal exposures to MPs. The evidence for environmental persistence and environmental mobility discussed in the previous section of this report further supports this determination.

[6] See Cal. Code Regs. tit. 22, section 69501.1(a)(57).
[7] See Cal. Code Regs. tit. 22, section 69501.1(a)(57).

Reliable Information Demonstrating the Occurrence, or Potential Occurrence, of Exposures to MPs

"Reliable information demonstrating the occurrence, or potential occurrence, of exposures to a chemical" is defined in the SCP regulations.[8] Based on that definition, reliable information demonstrating the occurrence, or potential occurrence, of exposures to MPs includes:

- Monitoring data that shows MPs to be present in household dust, indoor air, or drinking water (see Cal. Code Regs. tit. 22, section 69501.1(a)(58)(A)(1)).
- Monitoring data that shows MPs to be present in, or released from, products used in or present in homes, schools, or places of employment (see Cal. Code Regs. tit. 22, section 69501.1(a)(58)(A)(2)).
- Data that shows that MPs are present in stormwater and wastewater, and a fraction of them are discharged to receiving waters even after treatment in storm water and wastewater treatment systems (see Cal. Code Regs. tit. 22, section 69501.1(a)(58)(E)(4)).
- Data that shows that MPs are accumulative or persistent in the environment (see Cal. Code Regs. tit. 22, section 69501.1(a)(58)(A)(3)).
- Evidence that MPs exhibit the hazard trait of persistence (Cal. Code Regs. tit. 22, section 69501.1(a)(58)(C)(2)).

MPs have been reported in drinking water, household dust, and indoor air (Gasperi et al. 2018; Eerles-Medrano et al. 2019; Koelmans et al. 2019; Zhang et al. 2020; Soltani et al. 2021). MPs are used in a wide range of consumer products, including personal care products, cosmetics, household and industrial detergents, medical devices and medications, food products, paints and industrial coatings, waxes, polishes, decorative glitters, and textiles (European Chemicals Agency 2019; European Chemicals Agency 2021). MPs have been reported in personal care products including, but are not limited to, toothpaste, lipstick, mascara, eye shadow, eye liner, make-up preparations, bathing products, nail extenders, hair fixers and sprays, bulking agents, fragrance products, body and hand sprays, powders, shaving cream, baby products, and skin conditioning agents (Becker et al. 2014; United Nations Environment Program 2015). MPs are also present in clothing and textiles and are released during clothes washing (Hartline et al. 2016; Galafassi et al. 2019; Suaria et al. 2020). MPs are released from tires during use and from cigarette butts discarded to the environment (Sommer et al. 2018; Moran et al. 2021).

MPs are also used in a variety of applications in the oil and gas industry, in abrasive blasting, in adhesives, in controlled-release fertilizer applications, and in 3D printing. Laser printer toner is mostly made of granulated plastic particles (European Chemicals Agency 2019). Taken together,

[8] See Cal. Code Regs. tit. 22, section 69501.1(a)(58).

the available evidence shows that MPs are present in, or released from, products used in or present in homes, schools, or places of employment.

MPs end up in stormwater collection systems during rainfall and runoff events, and they directly discharge into receiving waters without treatment in most urban environments in California (Moran et al. 2021). Wastewater treatment plants receive municipal sewage that contains high levels of MPs, and a fraction of MPs are not removed during treatment and are released back to the environment (Conley et al. 2019).

As noted in the previous section of this report, MPs are ubiquitous in the environment and have been shown to persist in the environment and meet the hazard trait of persistence.

WHAT NEW REGULATORY REQUIREMENTS WOULD BE CREATED IF DTSC ADDED MPs TO THE CANDIDATE CHEMICALS LIST?

None. Adding a chemical to the Candidate Chemicals List does not create any new regulatory obligations or any new regulated entities. Adding a chemical to the Candidate Chemicals List allows DTSC to evaluate product-chemical combinations that contain MPs or that may release MPs to the environment for future consideration as potential Priority Products. New regulatory requirements would only result if DTSC lists a new Priority Product.

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