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FOLLOW-UP WORK EMANATING FROM THE ACTION PLAN TO ADDRESS MARINE PLASTIC LITTER FROM SHIPS

Safely managing the transport of plastic pellets at sea

Submitted by FOEI, Pacific Environment and CSC

SUMMARY

Executive summary:	This document makes the case for the classification of all plastic pellets, flakes and powders under the IMDG Code Class 9, to develop and mandate verifiable best practice handling, management, clear and consistent labelling, below deck stowage and emergency response procedures to contain and mitigate the impact of accidental losses
Strategic direction, if applicable:	4
Output:	4.3
Action to be taken:	Paragraph 22
Related documents:	MEPC 76/8; MEPC 77/8/3 and MEPC 77/8/4

Introduction

1 This submission elaborates on the issues identified in document MEPC 77/8/3 (Sri Lanka) which were directed to PPR 9 for further consideration of the proposals and development of advice for the Committee on how to proceed (MEPC 77/16, paragraph 8.21). It provides concrete recommendations for the consideration of the Sub-Committee in support of those discussions.

Plastic pellets: a growing hazardous threat

2 Plastic pellets, flakes and powders (hereinafter collectively referred to as "pellets") are the feedstock of the plastic supply chain and are melted and moulded by manufacturing companies into plastic products.[1] Pellets can be made from "virgin" polymer or recycled, end of life plastic. Far from being one substance, pellets are chemical cocktails composed of small building blocks (monomers) that have been joined together to create polymers. Over 10,000 chemicals (additives) are known to be added to plastic during upstream stages to change the polymer's performance characteristics, 24% of which are substances of concern and 39% of which are lacking data.[2]

1 OSPAR Commission, *OSPAR Background Document on Pre-Production Plastic Pellets* (2018), p. 2. Available here.

2 Wiesinger, H., Wang, Z., & Hellweg, S. (2021). Deep Dive into Plastic Monomers, Additives, and Processing Aids. *Environmental Science & Technology*. Available here.

3 Given their small size, pellets are easily and often spilt during production, storage, loading and unloading, transport, conversion and handling, with pellet loss to the environment (uncontained leaks and spills) occurring at each stage along the pellet supply chain. Pellets have been recorded on the coastlines of almost every country monitored,[3] negatively impacting marine life and degrading habitats.[4] Once in the environment, pellets also attract and concentrate persistent, bioaccumulating toxins such as dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCBs) which are present in ambient seawater. Many of these chemicals are especially concerning since they are known to have several endocrine (hormone) disrupting effects which pose a threat to both human health and the environment.[5]

4 Around 230,000 tonnes of pellets enter the environment each year, representing the second largest direct source of microplastics to the marine environment.[6] To put this into context, one pellet weighs less than half a gram, therefore, a loss of 230,000 tonnes is the equivalent of 460 billion lentil-sized pieces of plastic. Once in the environment, it is nearly impossible to contain and clean up pellets. However, this estimate only considers the 'slow and steady trickle' of pellet loss wherever they are handled, and ignores large-scale, acute yet preventable incidents such as the **MV X-Press Pearl** disaster (see document MEPC 77/8/3).

5 In May 2021, the latest of a recent swathe of acute loss incidents from container ships took place off the coast of Sri Lanka, spilling 1,680 tonnes[7] of plastic pellets directly into the ocean. This spill was ten times larger than anything that came before it and is probably the largest single plastic pollution emissions incident in history. The resulting impacts were catastrophic and will continue to cause irreparable social, economic and environmental harm for decades to come.

6 Despite the significant contribution of pellets to marine plastic pollution, and the increase in frequency and severity of acute incidents at sea, policymakers have been slow to propose regulatory solutions to address pellet loss. Action 12 of the IMO Action Plan to address marine plastic pollution from ships (resolution MEPC.310(73)), however, plans to "consider the most appropriate instrument to address the responsibility and liability for plastic consumer goods lost at sea from ships." Liability is highly relevant in the context of pellet loss given the protracted remediation and high financial costs of incidents such as the X-Press Pearl. This was recognized by the first global insurance industry study on managing the risks associated with plastic pollution, published by UNEP's Principles for Sustainable Insurance Initiative, which clearly recognized the increasing risks to marine underwriters and increasing plastic pollution liability claims.[8]

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3 FIDRA (2020). *Nurdle Free Oceans: Reducing Plastic Pollution in Our Seas* (website).

4 *See e.g.* Rochman, C. M. *et al.*, *Ingested Plastic Transfers Hazardous Chemicals to Fish and Induces Hepatic Stress* (Scientific Reports, 2013), p. 3; Nobre, C. R. *et al.*, *Assessment of Microplastic Toxicity to Embryonic Development of the Sea Urchin Lytechinus variegatus (Echinodermata: Echinoidea)* (Marine Pollution Bulletin, 2015), pp. 15, 99-104; Mato, Y. *et al.*, Plastic Resin Pellets as a Transport Medium for Toxic Chemicals in the Marine Environment (Environmental Science & Technology, 2001), pp. 35(2), 318-324.

5 IPEN (2021). Plastic pellets found on beaches all over the world contain toxic chemicals. Available here.

6 Eunomia (2016). Plastics in the Marine Environment. Available here.

7 This is the latest estimate. Data accuracy has previously been hampered by misleading labelling of cargo and details on the cargo manifest coupled with a broad range of issues that hampered clean-up efforts.

8 UNEP (2019). Unwrapping the risks of plastic pollution to the insurance industry. The first global insurance industry study on managing the risks associated with plastic pollution, marine plastic litter and microplastics. Available here.

The current regulatory framework

7 Work by GESAMP WG 40 and WG 43 recognize the significant contribution of plastic pellets to marine plastic and microplastic pollution globally.[9] Mishandling of cargo or accidental spills are the main reasons pellets are prevalent over other pollutants in many harbour sediments.[10] Despite this, the current regulatory framework for the handling and management of plastic pellets is virtually non-existent, and despite the IMO Action Plan, specific measures to prevent pellet loss at sea are absent.

8 While there is work happening under action 10 of the IMO Action Plan to reduce the risk associated with container loss at sea, this work stream will not fully address the issue of plastic pellet loss at sea. There is a clear need to prevent the loss of whole containers at sea, however, given the size and characteristics of plastic pellets and the volumes in which they are transported at sea, additional measures (including legal and financial incentives) are required to improve the packaging, labelling and loading of pellets into containers to prevent leakage from old or damaged containers coupled with more stringent rules on the loading and placement of containers full of pellets. Large-scale, acute loss incidents are outlined by GESAMP WG 43 (MEPC 76/8 (Secretariat)).[11] Furthermore, the issue of both chronic and acute pellet losses associated with cargo handling operations at ports or during cargo transport at sea was first evidenced by the United States Environmental Protection Agency (US EPA) in 1992, wherein plastic pellets were highlighted as a particular threat to the marine environment and a comprehensive list of recommended measures to be implemented by operators handling them on land and at sea were proposed.[12]

9 The US EPA report identified several pellet release pathways relevant to the shipping industry, including poor communication between relevant actors, careless routine operations, easily damaged or leaky packaging and improper shipping practices. Regarding the latter, improperly sealed valves, poorly maintained transporting vessels and inappropriate cargo handling practices can release large numbers of pellets to the environment.[13]

10 Operation Clean Sweep (OCS), an industry initiative to reduce pellet losses, recognizes the special attention required for transportation of plastic pellets at sea due to the high potential for releases into the environment.[14] However, the guidance for handling pellets at sea is notoriously vague and does not provide the level of guidance required on packing, marking, labelling, and placarding, documentation and stowage to facilitate best practice handling and management.

11 Document MEPC 77/8/4 (FOEI, Greenpeace International, WWF, Pacific Environment and CSC) highlighted the need to accelerate and coordinate global efforts to address marine plastic pollution given the current fragmented and inadequate regulatory

9 GESAMP (2016). Sources, fate and effects of microplastics in the marine environment: Part 2 of a global assessment. p.24. Available here.

10 GESAMP (2016). Sources, fate and effects of microplastics in the marine environment: Part 2 of a global assessment. p.24. Available here.

11 GESAMP (2021). Sea-Based Sources of Marine Litter. Available here.

12 United States Environmental Protection Agency (1991). Plastic Pellets in the Aquatic Environment: Sources and Recommendations. EPA842-B-92-010. *Final Report*. Available here.

13 United States Environmental Protection Agency (1991). Plastic Pellets in the Aquatic Environment: Sources and Recommendations. EPA842-B-92-010. *Final Report*. Available here.

14 Operation Clean Sweep (2021). OCS Manual. Available here.

framework.[15] In the case of pellets, while some measures exist at national and regional levels for preventing and controlling the release of pollutants such as pellets, none tackle losses at sea, and only IMO has the authority to authorize stricter measures obligating best practice handling and management during marine transportation.

The case for classifying plastic pellets as dangerous or hazardous substances

12 Tens of thousands of scientific papers documenting the presence of plastic in the ocean and its distribution, composition, physical and biological chemistry and toxicology, as well as its direct and indirect impacts on marine biota and habitats, have now been published.[16] As a result, there is widespread recognition of the harm that plastic pollution causes both physically and chemically to marine systems, including the release, accumulation and transfer of toxic chemicals.

13 Over recent years there has been increasing attention paid to microplastics (<5mm) (including pellets) as knowledge of their unique ability to negatively impact all levels of biological organization (from genes and cells to populations and ecosystems) has grown.[17] As a result of this body of work, it is recognized that microplastics can alter the functioning of important habitats,[18,19] impact growth, behaviour, development and reproduction of multiple different organisms,[20,21,22] and alter how species function, disperse and assemble.[23] Microplastics have also been identified as vectors for disease,[24] invasive species[25] and

15 Borrelle, S. B., Rochman, C. M., Liboiron, M., Bond, A. L., Lusher, A., Bradshaw, H., & Provencher, J. F. (2017). Opinion: Why we need an international agreement on marine plastic pollution. Proceedings of the National Academy of Sciences, 114(38), 9994-9997. Available here.

16 FAO (2020). Sea-based sources of marine litter – a review of current knowledge and assessment of data gaps (second interim report of GESAMP Working Group 43, 4 June 2020). COFI/2020/SBD.8. Available here.

17 GESAMP (2020). Proceedings of the GESAMP International Workshop on Assessing the Risks associated with Plastics and Microplastics in the Marine Environment. Available here.

18 Green, D. S., Boots, B., O'Connor, N. E., & Thompson, R. (2017). Microplastics affect the ecological functioning of an important biogenic habitat. *Environmental science & technology*, *51*(1), 68-77. Available here.

19 Huang, Y., Li, W., Gao, J., Wang, F., Yang, W., Han, L., ... & Yao, J. (2021). Effect of microplastics on ecosystem functioning: Microbial nitrogen removal mediated by benthic invertebrates. *Science of The Total Environment*, *754*, 142133. Available here.

20 Anbumani, S., & Kakkar, P. (2018). Ecotoxicological effects of microplastics on biota: a review. *Environmental Science and Pollution Research*, *25*(15), 14373-14396. Available here.

21 Sussarellu R, et al. (2016) Oyster reproduction is affected by exposure to polystyrene microplastics. Proc Natl Acad Sci USA 113:2430–2435. Available here.

22 Pedà, C., Caccamo, L., Fossi, M. C., Gai, F., Andaloro, F., Genovese, L., et al. (2016). Intestinal alterations in European sea bass Dicentrarchus labrax (Linnaeus, 1758) exposed to microplastics: preliminary results. *Environ. Pollut*. 212, 251–256. Available here.

23 Rochman CM, et al. (2016) The ecological impacts of marine debris: Unraveling the demonstrated evidence from what is perceived. Ecology 97:302–312. Available here.

24 Bowley, J., Baker-Austin, C., Porter, A., Hartnell, R., & Lewis, C. (2021). Oceanic hitchhikers–assessing pathogen risks from marine microplastic. *Trends in Microbiology*, *29*(2), 107-116. Available here.

25 Audrézet, F., Zaiko, A., Lear, G., Wood, S.A., Tremblay, L.A. and Pochon, X. (2021). 'Biosecurity implications of drifting marine plastic debris', Marine Pollution Bulletin. (162)111835. Available here.

antibiotic resistance,[26] representing a risk to global food security and planetary boundaries.[27] Commercially valuable fish stocks are also affected, with a 2021 study finding that 85.4% of commercial fish across 29 species had ingested microplastics.[28]

14 Moreover, of all the sources of microplastic to the marine environment, plastic pellets are the second largest by weight and volume.[29] There is no device, instrument, or methodology available today however to recover large quantities of pellets in a targeted manner post-loss. As such, microplastic pollution is seen as largely irreversible, and rather than eventually dissipating such as the case with oil spills, pellets will only fragment into smaller and smaller particles. Microplastic toxicity generally increases with decreasing particle size, so their toxicity increases as they slowly fragment in nature. Nanoplastics, for example, can cross over cellular membranes into the brain, where they can cause behavioural and neurological problems.[30] As a result of irreversibility and a worsening of potential impacts through time, prevention must take precedence over remediation.[31]

15 The toxic nature of the plastic pellets in the environment is acknowledged by GESAMP WG 43[32] and cannot be understated. In a recent study, plastic pellets from 23 different countries were analysed for 13 different types of polychlorinated biphenyls (PCBs) and 10 benzotriazole UV stabilizers (BUVs). All 23 sampled PCBs and BUVs (toxic chemicals) were found in samples from all locations in the study. The concentrations were particularly high in samples from African countries, which illustrates how African countries often bear a heavy burden of plastic pollution, even though they are not major producers of either chemicals or plastics.[33]

16 Unlike other microplastic sources, pellet loss is the one where the solution is readily available. It doesn't require rocket science, just simply good housekeeping, and therefore should be considered the "low hanging fruit" of microplastic pollution. Adding plastic pellets to the International Maritime Dangerous Goods (IMDG) Code Class 9 would mandate and thus ensure that proper handling, labelling and management is implemented during maritime transportation.

17 To that end, the co-sponsors propose that one of the two routes be forward under IMDG Class 9. Either the pellets are classified as "other substances or articles presenting a danger during transport" or as "environmentally hazardous substances".

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26 Arias-Andres, M., Rojas-Jimenez, K., & Grossart, H. P. (2019). Collateral effects of microplastic pollution on aquatic microorganisms: an ecological perspective. *TrAC Trends in Analytical Chemistry*, *112*, 234-240. Available here.

27 Arp, H. P. H., Kühnel, D., Rummel, C., MacLeod, M., Potthoff, A., Reichelt, S., & Jahnke, A. (2021). Weathering Plastics as a Planetary Boundary Threat: Exposure, Fate, and Hazards. *Environmental Science & Technology*. Available here.

28 Wang, Q., Zhu, X., Hou, C., Wu, Y., Teng, J., Zhang, C., ... & Zhao, J. (2021). Microplastic uptake in commercial fishes from the Bohai Sea, China. Chemosphere, 263, 127962. Available here.

29 Eunomia (2016). Plastics in the Marine Environment. Available here.

30 Mattsson, K., Johnson, E. V., Malmendal, A., Linse, S., Hansson, L.-A., and Cedervall, T. (2017). Brain damage and behavioural disorders in fish induced by plastic nanoparticles delivered through the food chain. Sci. Rep. 7:11452. Available here.

31 OSPAR Commission, *OSPAR Background Document on Pre-Production Plastic Pellets* (2018). Available here.

32 GESAMP (2021). Sea-based sources of marine litter. Available here.

33 IPEN (2021). Plastic pellets found on beaches all over the world contain toxic chemicals. Available here.

18 There is overwhelming evidence in favour of an IMDG listing for all plastic pellet resins under Class 9 due to the significant danger presented during transportation, and an "Other substances…" listing would be straightforward. As acknowledged by GESAMP WG 40 and WG 43, it is during loading and unloading of ships and subsequently during transportation that risk of pellet losses to the environment are highest, as evidenced by chronic routine leakage observed during cargo handling operations at ports or during cargo transport at sea and in the wake of several large-scale loss incidents over the past 10 years.

19 An "environmentally hazardous substances" listing is a second possible route but would require initiation of the analytical process for identifying if plastic pellets adequately meet the four criteria to be classified as "environmentally hazardous substances" (1. acute aquatic toxicity; 2. chronic aquatic toxicity; 3. potential for or actual bioaccumulation; and 4. degradation (biotic or abiotic) for organic chemicals). This is the co-sponsors' less preferred option due to the potential for delay to undertake an analytical process that already is supported by ample evidence. Furthermore, as previously noted, pellets are not one material but a cocktail of chemicals, thousands of which are used and many of which have variable synergistic effects when delivered or ingested in tandem. Size and shape also matter with respect to particle toxicity, which is challenging because pellets change size and shape as they weather. That said, a plethora of toxicological and ecotoxicological studies have assessed virgin plastics and their leachates, finding that they do elicit both acute and chronic toxic effects. Furthermore, despite pellet's low degradability and high affinity for bioaccumulation, as they are chemical mixtures, tests for these criteria "are not used as they are usually difficult to interpret, and such tests may be meaningful only for single substances."[34]

20 The co-sponsors would also like to make the following points for consideration during deliberations by the Sub-Committee:

.1 **Irreversibility:** pellet pollution is seen as 'poorly reversible' meaning once they are in the environment they will likely never be recovered.

.2 **Widespread economic, social, and environmental impacts:** the **MV X-Press Pearl** disaster caused the severe pollution of 750km of pristine biodiverse coastline, and a fishing ban over much of the West coast. With 40% of Sri Lankans reliant on fish as a primary source of protein and tourism heavily relied upon for income, the impacts extend far beyond environmental contamination. They will continue to have overwhelming economic and social implications for many years to come.

.3 **Transboundary issue:** uncontained pellets in the environment can travel thousands of miles as a result of both wind patterns and oceanic currents, and thus have a propensity to pollute a wide range of coastlines, negatively impacting a significant number of sensitive habitats.

.4 **Worsening over time:** the toxicity of pellets varies wildly based on several factors including the composition of additives and residual monomers and oligomers in the polymer matrix and the relevant concentrations of pollutants in the ambient environment. The longer pellets are in the environment, the more time they have to concentrate toxics and fragment into smaller particles including nano-plastics. As this occurs, their potential toxicity increases.

[34] International Maritime Dangerous Goods Code. Accessed January 2022.

.5 **Contribution to climate change:** plastic pellets present in the environment and exposed to UV radiation from the sun have been shown to release methane gas, a climate-change inducing gas four times more dangerous than carbon dioxide.[35]

21 In addition to these considerations, the co-sponsors recommend specific work is undertaken in the context of action 12 in the IMO Action Plan to develop guidance for insurers and marine underwriters in the context of liability and the transportation of plastic pellets. This could take the form of a Code of Conduct or other best practice guidance, which can be provided to industry to support the implementation of preventative measures during transportation.

Action requested of the Sub-Committee

22 The Sub-Committee is invited to consider the information and proposals provided in this document, in particular the steps as set out in paragraphs 12 to 21, and provide advice to MEPC on how best to proceed, for example, by establishing a working group to further develop the recommendations.

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[35] Royer, S. J., Ferrón, S., Wilson, S. T., & Karl, D. M. (2018). Production of methane and ethylene from plastic in the environment. *PloS one*, *13*(8), e0200574. Available here.