

## THE PRECURSORS TO ALL PLASTICS PRODUCTS

### SPILLAGE OF PLASTICS PELLETS, POWDERS AND FLAKES

#### *Their sources, fate, effects, and mitigation strategies*

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#### **Statement on definitions / functions / use, quantities and pathways to the environment:**

Microplastics are released to the environment at all stages of the plastic life cycle - including during the production of plastic product precursors, such as pellets (also known as nurdles) which are used as the raw material in the manufacturing of plastic products. Pellet loss is recognized as the 3rd largest source of unintentionally released microplastics. It is estimated that 160,000 tons of beads were lost in the EU and 230,000 tons were lost globally in 2023. <sup>1</sup> (See also <sup>2</sup>).



Figure 1: Pellets on a beach in Brittany, France. Photo credit: Juan Baztan

In addition to pellets (typically 3-5 mm in size), it is important to note that primary plastic polymers may be produced in other forms or shapes, including films, flakes and powders (< 1 mm in diameter) (hereafter referred to as pellets). They are produced from monomers, the raw materials or building blocks of plastics, as well as additives, processing agents and non-intentionally added substances <sup>3</sup> and are a source of microplastics in themselves. Further, plastic pellets may be produced from recycled plastics materials in waste stages. All plastics contain chemicals, including additives and non-intentionally added substances <sup>3</sup> but recycled plastics pellets can contain more complex mixtures of toxicants due to the complex and highly unregulated nature of plastics waste flows, mixtures of products containing unreported chemicals, and sources of contamination. <sup>4</sup>

Pellets are commonly lost to the environment through spills at production sites, during conversion, storage, handling, and during land-transport and shipping. They can accumulate in terrestrial soils or wash to streams and rivers via surface runoff and find their way to the ocean <sup>5</sup>. Rivers are an important pathway of pellets to the ocean and higher abundance of pellets are observed on beaches near river mouths. <sup>6</sup> Coastal environments are significant sites for the accumulation of pellets <sup>7</sup>, which is generally associated with onshore sources of pellets, port facilities, cities, and industrial areas <sup>8</sup> as well as spillage resulting from incidents at sea. Pellets can also be present in pristine coastal environments <sup>9</sup> due to long-range environmental transport via ocean current and wind from industrialised areas, leakage of pellets during maritime transportation, or following container negligence in handling, loss/shipping accidents, and environmental disasters. <sup>10</sup>

The X-Press Pearl disaster in Sri Lanka (May 2021) was the largest plastic-based disaster from a single vessel in maritime history: a spill of 12 000 MT of plastic materials, including ~70 billion plastic pellets. <sup>11</sup> These pellets accumulated on the beach several decimeters high, leading to social, economic and environmental repercussions. More recently a catastrophic plastic pellets spill occurred in European waters (December 2023). The Toconao, a Liberia-registered vessel chartered by the shipping company Maersk, lost 1,000 sacks, each containing 25 kg of pellets manufactured by the Indian company Coroplast <sup>12</sup>, 80 km offshore of Portugal. Days later pellets were found washing ashore across regions of Portugal, Spain and France (Ribeira). These are multinational operations, which highlights the need for global mitigation strategies.

Due to their small size and low density, pellets can be transported by wind and water (rivers, oceans) becoming dispersed over significant distances and geographic locations. Consequently, when spilled, there is no easy or effective way of cleaning-up pellet pollution from the environment. Therefore, prevention is key.

## Statement of impacts:

As with other plastics, pellets are transboundary in nature, persistent, remaining in the environment for many years, fragmenting into smaller micro- and nanoplastics over time. This fragmentation is influenced by ultraviolet light, heat, humidity and microorganisms, as well as wind or wave energy. Newly produced plastics pellets will contain a number of potentially hazardous chemicals, such as UV-stabilizers, while recycled plastics pellets will contain hundreds of additional chemicals that have sorbed into the plastics during the use and waste phases, including pesticides, pharmaceuticals, and persistent organic pollutants like PAHs and PCBs. <sup>4</sup> Further, pellets sorb environmental contaminants, acting as vectors for agrochemicals, and accumulating hazardous chemicals from the surrounding water that within a matter of days can become orders of magnitude more concentrated than in the surrounding water. <sup>8,13</sup> A shipping incident may involve cargo consisting of both plastics pellets and other chemicals or be associated with a fire, e.g. the X-pearl accident, and this combination can result in increased bioavailability and dispersal of other substances via the plastics.

Pellets can easily be mistaken for food by birds and marine organisms and ingestion of plastic pellets by wildlife has been recognised as potentially harmful for over 50 years with a substantial proportion of fish, turtles and sea bird populations being contaminated in some locations, <sup>19</sup> which can lead to negative consequences. Ingestion of pellets can cause physical and chemical impacts, <sup>14</sup> including structural damage to the digestive tract and disruptions in feeding behavior. Impacts on terrestrial biodiversity have been reported. <sup>20</sup> The toxic substances associated with plastics can have hazardous properties including metabolic, cancerogenic, endocrine or immunological effects. <sup>3</sup> Further, pellets can transport invasive species, including pathogens, and biofilms, composed of microorganisms that colonize the surfaces of microplastics, can harbor pathogens such as *Vibrio spp.* and *E. coli*, and antibiotic resistance genes. <sup>15,16</sup>

Additionally, harm may be measured in the form of socioeconomic damages, for example in impacts in economic sectors including coastal fishing communities and tourist industries. <sup>17,18</sup> An evaluation of the impacts of the pellets spill in Sri Lanka found major direct impacts on sensitive coastal environments, local communities and economy, and an estimated 20,000 fishing families were impacted following the X-Press Pearl spill. <sup>17</sup> Hence pellet spills pose a substantial risk to the resilience of marine and coastal socio-economic and ecological systems.

## Statement on potential Interventions:

Plastic pellet pollution is both a chronic problem and an acute one. While acute (e.g. X-Press Pearl) losses receive the majority of media attention, are easier to measure, and constitute international maritime disaster incidents, chronic (i.e. small but steady leaks) occur daily and are just as consequential. Pellets are lost at all stages of the supply chain. Consequently, coordinated international action to improve conditions and processes at all stages of the pellet supply chain are needed, including primary plastic polymer (PPP) reduction targets, prevention of emissions and release from production, storage, handling and transportation.

### Means to address pellet loss in the Plastics Treaty should include:

- following the waste hierarchy, and as a first priority, reducing primary plastics production.
- obligations on transparency and reporting concerning production of pellets (including information on volumes of polymers and chemicals)
- requiring instalment of traps to prevent loss within industrial facilities handling pellets
- obligations on transparency and reporting of shipping of pellets, and pellets loss and spills
- obligations on cleanups of spilled pellets via producer responsibility and dedicated funds
- mandatory EPR schemes throughout the entire life cycle of plastics
- increase awareness and requirements of workers handling and shipping pellets to avoid spills
- inclusion of pellets on HSN (Harmonised System of Nomenclature) lists
- harmonisation with existing legislation under e.g., Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL Convention), the London Convention and its Protocol, and regulation of spillage of pre-production pellets, powders and flakes during transportation by the IMO under the International Maritime Dangerous Goods Code(s)

**Please cite this as:** Carney Almroth, B., Courtene-Jones, W., Takada, H., Booth, A., Thompson, R., (2024) Spillage of plastic pellets, powders and flakes: Their sources, fate, effects, and mitigation strategies. Available from: <https://ikhapp.org/news-and-event/working-papers-developed-by-members-of-the-scientists-coalition/>

**Reviewers:** Susanne Brander, Marie-France Dignac, Trisia Farrelly

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