

Study to quantify plastic pellet loss in the UK



Report Briefing

A new study reveals that between 5 and 53 billion plastic pellets, or nurdles, may be lost to the environment each year through accidental spillage by the plastics industry. These estimates of pellet emissions are the first of their kind in Scotland and the rest of the UK. The pellets, which can be classed as a primary microplastic¹, are found in abundance on beaches around the UK coastline. With mounting evidence of their harm to marine ecosystems, this report highlights the vast scale of an issue, which, until now, has remained almost entirely hidden from the public eye.



¹ Cole, M., et al. "Microplastics as contaminants in the marine environment: a review." *Marine pollution bulletin* 62.12 (2011): 2588-2597.

What are nurdles? Every year, 2.5 million tonnes of plastic is produced, and 4.8 million tonnes processed to create new products in the [United Kingdom](#). The vast majority² of this plastic starts life in the form of small pellets known as nurdles. They are generally 3-5mm in diameter, around the size of a lentil, and weigh ~20mg each. For example, around 600 nurdles are used to make a small disposable water bottle.

Nurdles – an environmental pollutant: Tiny and lightweight, nurdles are easily spilled during handling in all sectors of the industry, from pellet production, transport to final plastics manufacture. As a result, many find their way into the marine environment through drains and watercourses. Of similar size and shape to fish eggs, they are often mistaken by marine animals for food and ingested, which can inhibit appetite³. Like other microplastic particles, nurdles are efficient at adsorbing chemicals known as Persistent Bioaccumulating Toxins (PBTs) to their surface, where they can concentrate to extreme levels⁴. It is still unclear whether this combination of effects might increase toxin accumulation in animals, and up the food chain⁵.

Study background: The new scoping study was commissioned by Fidra, and conducted by Eunomia Research and Consulting. It reviews previously published research from other pellet loss studies from around Europe, incorporating new evidence from interviews with industry to come up with the first estimates of pellets lost to the environment in the UK and Scotland.

Results: The final estimate suggests that only a tiny proportion (0.001-0.01%) of pellets handled are likely to be lost. The estimate counts among the most conservative compared to other EU studies⁶. Despite this, the huge amount of raw material handled in the UK each year means this still equates to billions of pellets escaping to the environment. Full results are shown in the table below.

The study suggests that up to 53 billion pellets could be lost to the wider environment in the UK each year. That's the equivalent of 35 full tanker-loads of pellets spilled.



Industry Sector	UK figures		Scotland Figures*	
	Weight, tonnes (min-max)	No. of pellets, billions (min-max)	Weight, tonnes (min-max)	No. of pellets billions (min-max)
Production	25 – 250	1.3 – 13	3.8 – 37.5	0.2 – 1.9
Transport+	32 – 320	1.6 – 16	4.8 – 48.0	0.2 – 2.4
Processors	48 – 480	2.4 – 24	7.2 – 72.0	0.4 – 3.6
Waste Management	0 – 4	0.0 – 0.2	0.0 – 0.6	0.0 – 0.03
TOTAL pellets lost	105 – 1054	5.3 – 53	15.8 – 158.1	0.8 – 7.9

*estimated 15% of total in UK, based on relative proportion of chemicals industry.

+ 'Transport' includes losses at other facilities that handle pellets between production and final use (e.g. intermediate storage)

2 Information provided by the British Plastics Federation (BPF)

3 Azzarello and Van Vleet (1987) Marine birds and plastic pollution, *Marine Ecology – Progress Series* Vol 37: 295-303.

4 Teuten, E.L., et al. (2007). Potential for plastics to transport hydrophobic contaminants. *Environmental Science & Technology* 41, 7759–7764.

5 Rochman et al (2013) Ingested plastic transfers hazardous chemicals to fish and induces hepatic stress. *Scientific Reports* 3, article number 3263.

6 E.g. The Danish Environmental Protection Agency (2015) *Microplastics - Occurrence, effects and sources of releases to the environment in Denmark, 2015 - equal estimate of 0.001-0.01%*, Mepex (2014) Sources of microplastic pollution to the marine environment, Report for Norwegian Environment Agency, April 2014 – suggests 0.04-0.09% loss. Roland Essel, and et al. (2014) Sources of microplastics relevant to marine protection, Report for Federal Environment Agency (Germany), November 2014 – suggests 0.1-1.0% loss from total production.

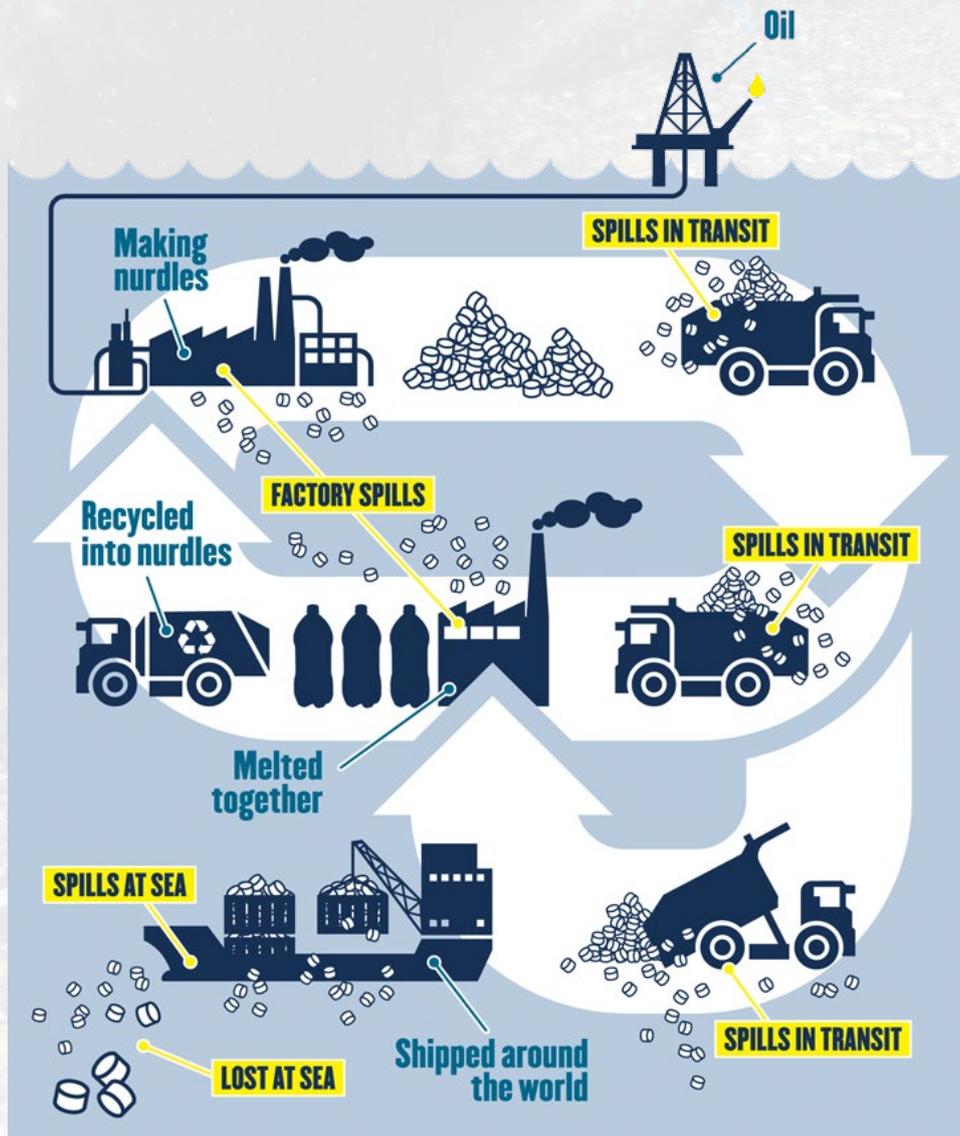
Data gaps and limitations: Several key gaps in knowledge have been highlighted in this report due to a lack of direct data available e.g. 1) location, size and nature of plastics facilities in Scotland and the UK, 2) Relative loss in different facilities, 3) The number of pellets lost to areas other than the drains e.g. outdoor spaces, or lost in transport accidents 4) Relative losses of other pre-production plastic materials, e.g. powders and flakes. The study does not attempt to estimate proportion of lost pellets that reach the sea.

Key Recommendations:

- **Viewing procedure from an environmental perspective in industry:** Health and safety considerations, and potentially, under some circumstances, the possibility of returning feedstock to the production process, means the majority of pellets will likely be cleaned up if spilled. However, there are diminishing returns to effort in cleaning up nurdles, which on an individual basis, have little value (250 pellets = 1p). **An additional environmental perspective is vital to ensure zero pellet pollution.**
- **Encouraging industry uptake of Operation Clean Sweep® (OCS):** An initiative such as OCS encourages viewing procedures from an environmental perspective. However, sign-up to the scheme remains low across the UK plastics industry.
- **Evaluating effectiveness of the OCS scheme:** The OCS scheme is currently entirely voluntary and there is no mechanism for reporting, or enforcement of pellet loss measures. A monitoring study would ensure that the OCS scheme is an effective solution for reducing plastic pellet pollution.
- **Enforcement:** Engaging with government bodies and environment agencies to establish a means for enforcing pellet loss reduction could an important next step, especially if OCS sign-ups remain low and its effectiveness remains unproven.
- **Systematic monitoring of pollution:** More systematic pellet pollution statistics in the marine environment are required. The Great Nurdle Hunt [online map](#) has been an effective method to gather data about pellet pollution hotspots, and could be incorporated into national beach litter surveys to create a more systematic dataset.

What is Operation Clean-Sweep® (OCS)? OCS is an industry-devised scheme that allows companies to pledge their commitment to reducing pellet loss to zero, supported by the [British Plastics Federation](#) and [Plastics Europe](#). A manual is used as a starting point for conducting an audit within the company, to highlight high-risk areas where pellets may be spilled. Companies are then expected to take measures to improve procedures and ensure zero pellet loss.





Plastic pellets can be spilled at any point of handling in the plastics supply chain, including production, transport, processing and even plastics recycling.

The full report is available to read [online](#). For further information, please do not hesitate to contact us:

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Fidra: Fidra is a charity based in East Lothian, Scotland. We seek to find ways to engage local concerns over current and emerging environmental issues, and use this to contribute to wider dialogue at national and international levels, using scientific evidence and best practice to establish how best to influence positive environmental change. [The Great Nurdle Hunt](#) is Fidra's first project. It aims to end further industrial plastic pellet pollution into the marine environment through a combination of public education, academic research and corporate engagement. *Fidra is a Scottish registered charity and SCIO no.SCO43895.*