

Nurdles

Nurdles are small pellets of plastic resin that can be melted to form plastic products. They are sometimes lost during transport or other activities and make their way into the environment.



Photo: Madeleine de Young

Nurdles: Frequently Asked Questions

Nurdles are appearing on coastlines and in the news at an increasing rate. What are they, what potential impacts do they have on the environments they enter, and what kinds of policies are in place to deal with them?

Did you know?

The smallest building blocks of traditional plastics are byproducts of refined crude oil and natural gas.¹ Through complex chemical processes, these building blocks (monomers) are linked together to form larger molecules called polymers.² Plastics manufacturers manipulate the combination of monomers incorporated into polymers, as this determines the properties – such as rigidity and temperature resistance – and the potential uses of the plastic produced.

What are nurdles?

Nurdles are plastic resin, roughly the size of a pencil eraser (2-5 mm). These pellets of raw plastic are melted down and used in the production of a wide variety of everyday plastic items such as take-out food containers, single-use water bottles, toys, and computer parts. Intentionally sized for easy transport, nurdles are moved around the country by truck, rail, and cargo vessel to facilities where they can be transformed from plastic pellets into plastic goods.

What are the environmental impacts and implications?

During transit, or even during manufacturing, nurdles may be accidentally released into the environment.³ Because some nurdles are buoyant, once in the water they may be transported throughout marine and coastal environments via physical factors such as waves, tides, and wind-driven currents.⁴ Hydrophobic environmental contaminants – those that repel water but mix well with oil – tend to stick to not only natural materials like sediments but also to human-made materials like plastic. These contaminants include but are not limited to polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and certain pesticides.^{5,6}

The accidental release of nurdles is problematic as it adds to the pre-existing abundance of microplastics in major water bodies, such as the Gulf of Mexico.⁷ Due to their small size, nurdles can be accidentally consumed—along with the contaminants adhered to them—by a variety of aquatic life. This can result in multiple negative impacts on organisms consuming nurdles. Scientific studies indicate that when eaten, plastic debris and microplastics (like nurdles) provide no nourishment but may produce a false sense of fullness, reducing the organism's desire to feed while also creating physical blockages and punctures in the digestive tract.^{8,9} Additionally, the contaminants adhered to the ingested nurdles may release from the plastic and leach into organisms that consumed them.⁶ Though contaminated sediments may also be ingested by and leach into aquatic life, the levels of contaminants that leach from nurdles can be higher than from ingested sediments.⁶

Scientists found that nurdles can become weathered (aged) by the sun and physical wear on the plastic due to the coastal environment.^{6,10} This creates scars on the face of the nurdles. These scars create more surfaces for environmental contaminants to adhere to.⁶ Interestingly, contaminants adsorbed to highly weathered nurdles are not as easily released into the digestive tracts of organisms as contaminants from lightly weathered nurdles are. In addition to potentially introducing environmental



contaminants into the food web, nurdles (especially ones with increased surface area due to weathering) also create a surface for growth of undesirable microbes such as *E. coli* and some species of *Vibrio*, as was seen in studies of nurdles on beaches in the United Kingdom.¹¹

What regulations and case studies exist regarding nurdles?

Federal level

Under the federal Clean Water Act (CWA), manufacturers can still discharge a certain amount of pollutants into waterways as long as they have a permit and abide by those limitations and rules set within the permit.¹² There are no federal laws that define a limit for plastic pellets.¹³ However, the Break Free from Plastic Pollution Act was recently reintroduced to Congress on March 25, 2021, after being dismissed the previous year.¹⁴ This act would require numerous improvements to federal plastics laws, ban single-use plastics, and expand standards for items such as plastic pellets and microplastics. Although plastics, specifically plastic pellets, are not currently regulated under the CWA, there are states that are aiming to reduce plastics at the state level.

State level

In 2008, California passed a bill known as the *Plastic Pellet Litter Prevention Bill*.¹⁵ This bill allowed for tighter restrictions on plastic pellet manufacturing under the CWA by monitoring and regulating the release of all plastic pellets and issuing penalties for those who violate the new standards.¹⁶ In 2015, there were two major settlements by plastic manufacturers under the new bill as those facilities did not implement the mandated proper plastic discharge control measures within their plants.¹⁷

California is not the only state aiming to tighten regulations on plastic; Texas and South Carolina have also begun to issue penalties for plastic pellet pollution. In Texas, the Texas Center on Environmental Quality (TCEQ) has recently aimed to update plastic pollution legislation by revising its current permitting systems to clarify the zero discharge requirements for wastewater in plastic manufacturing facilities for pre-plastic products.¹⁸ Most notably, in 2019, a Formosa Plastic plant in Texas was involved in a settlement of \$50 million for violations of the *Water Pollution Control Act* and their Texas Pollutant Discharge Elimination System permit (TPDES) under the CWA.¹⁹ The permit prohibited all discharges of floating or suspended solids or visible foam into surface waters, and if such an incident occurs, the facility was required to notify TCEQ within 24 hours.²⁰ Formosa not only discharged plastic pellets violating the zero discharge limits, but it also did not report any of the spills or accidental/incidental releases of these plastic pellets, therefore violating its permits.

Similarly, in South Carolina, there is an ongoing case wherein the defendants spilled large quantities of nurdles in a harbor, therefore violating the *Resource Conservation and Recovery Act* (RCRA) and *Clean Water Act* (CWA).²¹ They found that the plastics company had failed to implement sufficient measures to prevent the spill and discharge of these plastics and further failed to clean the spills after their occurrences.²¹ The court noted that not only do the nurdles classify as solid waste under the RCRA but also as a discharge under the CWA, thus allowing the plaintiffs to sue the defendants under both acts.²¹

Industry

Due to the lack of plastic control laws, the U.S. does have a voluntary option for plastic manufacturing companies to participate in. This program is known as *Operation Clean Sweep* (OCS) and the *OCS Blue Program*.²² The OCS program gives companies goals and standards which the companies are to implement within their facilities that aim to reduce plastic pollution and plastic pellet contamination.²³ In addition, OCS provides its members with best management practice guides all facilities are to incorporate into their companies that includes everything from training employees to installing containment systems.²³ OCS Blue is a step above OCS and requires companies who participate to report any spills from resin handling facilities and the number and volume of these incidents.²⁴

Nurdles of various colors – white, gray, black, red – found on a beach.

GLOSSARY

Microplastic — Pieces of plastic 5 mm or smaller.

Polychlorinated biphenyls (PCBs) — A class of banned, human-made, carbon-hydrogen-chlorine-based chemicals once used in a variety of applications including but not limited to paints, adhesives, and plastic, as well as electric and hydraulic equipment. Though banned in the U.S. due to their toxicity, these compounds are highly persistent in the environment and can accumulate in the tissues of exposed animals and humans.

Polycyclic aromatic hydrocarbons (PAHs) — A group of hydrocarbons (compounds composed of hydrogen and carbon) commonly found in oil, tar, burned wood, and animal fats.

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