The Rapids

US EPA's Trash Free Waters Monthly Update

December 2023

epa.gov/trash-free-waters

Introduction

Hello all,

In November, the non-governmental organization 5 Gyres Institute published Better Alternatives 3.0: A Case Study on Bioplastic Products and Packaging. Scientists at the organization studied the breakdown of traditional plastics versus biopolymers in marine environments in California, Florida and Maine over the course of 64 weeks. The report evaluates whether bioplastics are a "solution or pollution", considering the use of bioplastics and proper management at their end of life. 5 Gyres Institute hopes that the results of this study will help provide clarity and context to inform decision-making around plastic products and packaging.

ASTM Standard E3332 - Standard Test Method for Determining Trash and/or Debris Capture Performance of Stormwater Control Measures – was finalized in January 2023. The Stormwater Testing and Evaluation of Products and Practices program, led by the National Municipal Stormwater Alliance, will be verifying tested technologies meet the new standard. ASTM is also developing a new standard for microplastics capture for stormwater control measures.

Please share any upcoming events with me at nandi.romell@epa.gov so that the Trash Free Waters Team can advertise these opportunities.

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Trash Free Waters National Program Lead

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EPA Announcements

Biden-Harris Administration Announces More than $90 Million in Tribal Recycling Infrastructure Projects and Recycling Education and Outreach Grants

On November 15, the EPA announced 59 recipients of more than $60 million in Solid Waste Infrastructure for Recycling grants for Tribes and Intertribal Consortia. Projects include mobile recycling stations, construction of an energy-efficient cardboard processing facility, implementation of a school-based curriculum on sustainable alternatives, single-use plastics and many others.

Funding Opportunities

The **EPA Green Chemistry Challenge Awards Program**

The EPA Green Chemistry Challenge Awards promote the environmental and economic benefits of developing and using novel green chemistry. These prestigious annual awards recognize chemical technologies that incorporate green chemistry into chemical design, manufacture and use. Award categories include three focus areas—Greener Synthetic Pathways, Chemical and Process Design for Circularity, and Design of Safer and Degradable Chemicals. The awards also recognize technologies in the focus areas that reduce or prevent greenhouse gas emissions or were developed by a small business or academic researcher. **Application period closes on December 8, 2023.**

Mutual of Omaha's Wild Kingdom College and University Grant Program

New in 2023—Mutual of Omaha's Wild Kingdom College and University Grant Program is accepting applications to fund "innovative and/or solutions-based programs or strategies that help protect and/or restore wildlife and/or their key habitats." Faculty or staff of any college or university in the United States are eligible to apply. Awards range from $7,500 to $10,000. **Applications are due December 15, 2023.**

U.S. Department of Agriculture's Rural Development Solid Waste Management Grants

The National Marine Sanctuary Foundation and NOAA Marine Debris Program are offering funding to support underserved, underrepresented or overburdened communities in promoting initiatives that investigate and prevent adverse impacts of marine debris in the United States. Awards will range from $5,000 to $7,500 and will support 10-15 projects. Project activities may include marine debris prevention, research, monitoring, detection, response, removal and coordination. **Applications are due December 18, 2023.**

Presidential Innovation Award for Environmental Educators

The EPA and the Council on Environmental Quality's Presidential Innovation Award for Environmental Educators recognizes K-12 teachers with innovative approaches to environmental education and who use the environment as context in their teaching. Outstanding teachers from each of the EPA's ten Regions may be selected, with up to two teachers per Region. Teachers are selected based on the following criteria: Innovation, Achievement, Service to the Community and Underserved Populations, Leadership, Integration, sample teaching materials and letters of support. Winners will receive an award plaque, up to $2,500 for professional development, up to $2,500 for their local education agency and a congratulatory letter from a senior official at the EPA and/or the White House. **The application deadline is January 15, 2024.**

Five Star and Urban Waters Restoration Grant Program

The Five Star and Urban Waters Restoration grant program seeks to develop community capacity to sustain local natural resources for future generations by providing financial assistance to diverse local partnerships focused on improving water quality, watersheds, and the species and habitats they support. Projects include a variety of ecological improvements along with targeted outreach, education and stewardship. Awards will range from $30,000 to $60,000. Each year, the Five Star and Urban Waters Restoration program awards 30 to 40 grants. **Full proposals are due on January 31, 2024.**

Inflation Reduction Act Community Change Grants Program

EPA's new Environmental and Climate Justice Community Change Grants program (Community Change Grants) has announced a Notice of Funding Opportunity for approximately $2 billion dollars in Inflation Reduction Act funds in environmental and climate justice activities to benefit disadvantaged communities through projects

that reduce pollution, increase community climate resilience, and build community capacity to address environmental and climate justice challenges. These place-based investments will be focused on community-driven initiatives to be responsive to community and stakeholder input. Eligible parties are partnerships between two community-based non-profit organizations (CBOs), or partnerships between a CBO and one of a Federally-recognized tribe, a local government, or an institution of higher learning. **Applications are due November 21, 2024.**

Upcoming Events

Virtual Grassroots Organizing Training

December 2-7 (choose two out of four 2-hour sessions), virtual

Beyond Plastics is hosting a free training for grassroots organizations on strategies to help end plastic pollution and engage communities. The training is divided into two 2-hour sessions. Each session is offered twice to allow flexibility with schedules. The trainings cover: Plastics 101, how ordinary people can make legislative change, essential media skills, grassroots organizing skills, community education and more. Spanish translation is available.

Advancing Climate Change Mitigation Goals through Improved Solid Waste Management

December 4 (8-9:15 AM ET), virtual

In recognition of the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change, the United States Agency for International Development Clean Cities, Blue Ocean program—the Agency's flagship program to address ocean plastic pollution under the Save our Seas Initiative—invites you to learn more about sustainable, climate-smart waste management practices being implemented by the program and its partners, such as disposal site remediation, improved waste collection and routing, and advancing the 3Rs (reduce, reuse, recycle).

Sustainable Plastics Live

December 5 (10 AM ET), virtual

Sustainable Plastics is hosting a webinar focusing on what makes a plastic package sustainable, including what strategies companies are using to reduce carbon footprint and improve recyclability while still meeting consumer and brand owner expectations. The webinar will also discuss whether plastics can compete with other materials.

Mid-Atlantic Marine Debris Summit

December 6-7, Ocean City, Maryland

The Mid-Atlantic Regional Council on the Ocean is hosting the 2023 Mid-Atlantic Marine Debris Summit in Ocean City, Maryland, to bring together Tribes, federal and state agencies, non-profit organizations, academia and other groups from the mid-Atlantic working on marine debris issues. The two-day summit will feature talks, poster sessions and networking opportunities. The summit is free to attend and open to the public. Limited travel assistance funds are available for speakers, students and Tribal members.

Vinyl Chloride and the EPA: The Urgent Case for Action

December 11 (7-8 PM ET), virtual

Beyond Plastics is hosting an educational webinar discussion on the dangers posed by vinyl chloride and its toll on human health. In 1974, the EPA banned the chemical as an aerosol propellant. The EPA is currently considering adding vinyl chloride to its list of chemicals to reassess for a ban or restriction due to its toxicity. Guests will include experts David Rosner, Ph.D., MPH, of Columbia University and Jess Conard, the Appalachia Director of Beyond Plastics.

Tiny Plastics with a Big Impact: Exploring the Connection Between Microplastics and Trash in Stormwater Best Management Practices

December 12 (2-3:15 PM ET), virtual

This Stormwater University sponsored webinar will explore the latest research and regulations on plastic trash and secondary microplastics in our receiving waters, including their sources, transport and removal in proprietary and non-proprietary best management practices. Two researchers and a regulator in the field will share their insights: Dr. Andy Erickson, a Research Manager at St. Anthony Falls Laboratory and the University of Minnesota; Katie Senft, an associate specialist, scientific diver and member of the Diving Control Board at the University of California at Davis Tahoe Environmental Research Center; and Karen Mogus, Deputy Director at the California Water Resources Control Board.

In case you missed it...

Reimagining Circularity in the Textile Industry

Hosted by EPA Region 4 and Region 7, the Center for Biomimicry, and North Carolina State University, this webinar focused on the "textiles food web" and "materials metabolism." Speakers Beth Rattner and Lauren Bright from Biomimicry Institute and Sonja Salmon from Wilson College of Textiles explored new visions for materials of the future. **Webinar passcode: 19604160**

State of the Science: Breaking Down Biomaterials

This webinar, presented by the NGO 5 Gyres Institute, covered the topics of bioplastics — what we know about the material, where it offers promise, and where we need to be cautious. The webinar was a follow-up to the Better Alternatives 3.0: A Case Study on Bioplastic Products and Packaging report from 5 Gyres that was mentioned in the introduction to this issue of the *Rapids*.

Uniting States Against Plastic Pollution

Hosted by Environment America and the Public Interest Network, this webinar featured advocates and elected officials from California, Massachusetts, Oregon, Washington and Colorado who discussed recent state policies and policy ideas for tackling plastic pollution.

Cigarette Butts: How to Manage the World's Most Littered Item

This webinar, presented by Be Water Wise, featured a panel of experts who discussed the environmental risks due to cigarette butt littering and explored the economically and environmentally sustainable technologies for repurposing them. Panelists discussed innovative ideas to address this environmental challenge.

Chemical Recycling: A Dangerous Deception

In this webinar, Lee Bell of International Pollutants Elimination Network (IPEN) and Judith Enck and Jennifer Congdon of Beyond Plastics discussed the findings of Beyond Plastics and IPEN's recently published report, "Chemical Recycling: A Dangerous Deception". They also discussed the reality on the ground at 11 existing chemical recycling facilities in the United States.

Trash-Free Webinar: You Are What You Eat (and Breathe): Exposure and Impacts of Nano- and Microplastics on Human Health

This webinar, presented by Trash Free Waters, featured three speakers on what we do and do not know about human exposure to micro- and nanoplastics and their health impacts. Speakers included: Todd Gouin, PhD from TG Environmental Research; Charlie Rolsky, PhD from Shaw Institute; and Scott Coffin, PhD from California State Water Resources Control Board.

The Microplastics Breakdown

MICROPLASTICS LAW AND POLICY

EU Agrees to Ban Exports of Waste Plastic to Poor Countries: Rules, Still Subject to Formal Approval, Stop Exports to Non-OECD Countries and Limit Them Elsewhere: The EU has Struck a Deal to Stop Ships of Waste Plastic Landing in Ports of Poor Countries.

Ajit Niranjan

On November 17, 2023, the European Union (EU) agreed to ban exports of plastic trash to countries outside the Organization for Economic Cooperation and Development (OECD) starting from the middle of 2026, for a period of at least five years. After five years, countries who then wish to import EU plastic waste can request the ban be lifted if they can demonstrate that they can effectively treat it. Most plastic thrown away in Europe gets burned, and less than a third gets recycled. Additionally, the rules that were part of this agreement would allow for some forms of non-plastic waste to be shipped to non-OECD countries if they fulfil certain social and environmental criteria. The article highlighted the enactment of these rules could also lead to an increase in waste shipped to OECD countries such as Turkey, which was described as the largest importer of plastic waste in the EU. **Read the full article:** https://www.theguardian.com/environment/2023/nov/17/waste-plastic-eu-ban-exports-non-oecd-countries

New York Attorney General Sues Pepsi in New Plastic Pollution Fight: This Is a First-Of-Its-Kind Lawsuit as States Across the Country Struggle With How to Tackle the Growing Amount of Plastic Packaging Ending Up in Landfills.

New York Attorney General Tish James is testing a new legal strategy to fight plastic pollution in what could be a model to force companies to reduce single-use packaging. James announced a lawsuit against PepsiCo, the largest food and beverage company in North America, on November 15, 2023 in Buffalo. The company is responsible for much of the plastic trash picked up by volunteers along waterways in Buffalo and has misleadingly told investors and consumers that it is working to reduce new plastic use, James said. This is a first-of-its-kind lawsuit as states across the country struggle with how to tackle the growing amount of plastic packaging ending up in landfills. It could provide a pathway to force companies to take on more responsibility for the waste they generate and the impact that plastics have on the environment.

Read the full article: https://www.politico.com/news/2023/11/15/new-york-attorney-general-sues-pepsi-plastic-pollution-00127338

MICROPLASTICS FATE AND TRANSPORT

Occurrence and Characteristics of Microplastics in Greywater from a Research Vessel

Yu Lee Jang, Jongwook Jeong, Soeun Eo, Sang Hee Hong, Won Joon Shim
This article identified as a growing concern the discharge of greywater from ships as a source of microplastics. Using samples taken from April 21 to May 9, 2022, the researchers investigated the abundances and characteristics of microplastics in greywater from a 1992 Norwegian marine research vessel based on the kind of water usage (e.g., galley, cabin and laundry). In total, 2169 microplastic particles were found; The highest mean abundance of **microplastics** was found in samples of greywater from the laundry, followed by the cabins and galley. Notably, the researchers observed that the greywater from the galley, cabins and laundry contained similar levels and compositions (shape, size, and polymer) of microplastics. Fibers were the most prevalent shape identified, accounting for 66% of the total microplastic abundance, and fragments accounted for 34% of the microplastics found. The dominant polymer identified in all greywater samples was polyester (53%), followed by polypropylene (23%). Annual microplastic emissions per person by the greywater discharge of the research vessel was estimated to be to 3.0 grams per person per year.
Read the full abstract: https://www.sciencedirect.com/science/article/pii/S0269749123019437

EXPOSURE TO MICROPLASTICS AND POTENTIAL EFFECTS

The Association Between Microplastics and Microbiota in Placentas and Meconium: The First Evidence in Humans

Shaojie Liu, Xinyuan Liu, Jialin Guo, Ruoru Yang, Hangwei Wang, Yongyun Sun, Bo Chen, and Ruihua Dong

This article explores microplastics in samples of placentas and meconium**[1]** and the potential correlation of microplastics exposure with microbiota in placentas and meconium. As described, these samples were taken from eighteen mother–infant pairs in Shanghai, China. Sixteen types of microplastics were found with more than 76% sized 20 to 50 micrometers. Most of the particles retrieved were polyamide and polyurethane. The microbiota found in both the placenta and meconium microbiota were mainly proteobacteria, bacteroidota and firmicutes. Significant differences were found in the microbiota identified in the placenta and in the meconium microbiota in terms of the species diversity and in their gut composition. The researchers identified an inverse relationship between the levels of polystyrene and the meconium microbiota. Polyethylene was consistently found to be inversely correlated with several genera of the placenta microbiota as well. The total number of microplastics and levels of polyamide and polyurethane, respectively, were reported to consistently have impacted several genera of meconium microbiota. These results indicate a wide exposure of pregnant women and infants to microplastics. Furthermore, findings support a link between high concentration of microplastics and microbiota genera in placentas and meconium. **Read the full abstract:** https://pubs.acs.org/doi/10.1021/acs.est.2c04706

[1] Meconium is the initial substance present in the intestines of the developing fetus and constitutes the first bowel movement of the newborn. https://www.ncbi.nlm.nih.gov/books/NBK542240/

The Impact of Microplastics on Global Food Production: A Brief Overview of This Complex Sector

Thúlio Righeti Corrêa, Christine C. Gaylarde, José Antônio Baptista Neto, Jéssica de F. Delgado, Leonardo da S. Lima, Danieli L. Cunha and Estefan M. da Fonseca

This article highlights the effect of microplastics on the balance of terrestrial, aquatic and aerial ecosystems. The article focused on microplastic effects on species as they circulate through food and water, as well as effects on the global production of food, and found that the negative impacts of microplastics are intensified when they adsorb toxic chemicals. The article describes several potential sources of microplastic in agricultural areas—tire fragments, shattered macroplastic released into the atmosphere by littering, the application of biosolids, the application of soil corrective dressings, agricultural plastic film, chemical additives and pesticide packaging residues, wastewater watering, surface runoff and atmospheric deposition. The article also described the accumulation of microplastics in specific organisms. The authors described a study finding that 63% of brown

shrimp collected from the English Channel contained microplastic fibers. The authors also noted examples of impacts of microplastic exposure, such as neurotoxicity, reduced physiological development and behavioral disorders in fish. The effects of microplastics were proportional to their available levels and associated pollutants. The negative impacts of microplastics were divided into two categories: physical and chemical. Physical impacts are related to the size and shape of the particles; such impacts include the obstruction of the digestive system, which could result in mechanical damage such as perforation of the stomach and intestine and, in more serious cases, the death of the organism. Chemical impacts were those resulting from the polymer composition, the inclusion of chemical additives during plastic matrix production, or the carriage of toxic compounds captured from the surrounding environment. The authors observed that there is a difference between farm production and aquaculture, which can be attributed to the multiple routes (gut, gills) of plastic uptake in aquatic species and a single route (gastrointestinal) in terrestrial animals. Both types of impacts, mechanical (abrasion) or chemical (inflammation), can occur within various systems of the organism, such as digestive, respiratory, circulatory, neurological and reproductive, due to the ingestion and accumulation of microplastics. The authors also note that there remains a substantial lack of information about the response of organisms to microplastics in aquaculture systems—especially about farmed fish. Some research has found that some farmed fish lose the ability to differentiate between edible and inedible particles, reducing their ability to avoid ingesting microplastics. However, some research indicates farmed fish contain fewer microplastics because of the comparative cleanliness of the water. **Read the full abstract:** https://www.mdpi.com/2673-8929/2/4/28

Microplastics Exposure Promotes the Proliferation of Skin Cancer Cells but Inhibits the Growth of Normal Skin Cells by Regulating the Inflammatory Process

Yuchen Wang, Xinqi Xu, Guan Jiang

Cutaneous squamous cell carcinoma—the second most common nonmelanoma skin malignancy in humans—is one of the most common malignant tumors of the skin, occurring primarily in the elderly population. The authors observed that the effect of microplastics on skin cancer is not yet known and is an important scientific question that needs to be addressed. To help shed light on this topic, the study centered on the effects of microplastics on two squamous cell carcinoma cell lines (SCL-1 and A431). These cells were exposed to microplastics under various conditions and observed using several different tools. Microplastics were found to have been internalized into the skin squamous cell carcinoma cell line in a time- and dose-dependent manner. Furthermore, the microplastics were found to promote the proliferation of skin cancer cells by MTT**[1]**, flow cytometry, laser confocal microscopy, western blotting and other experimental techniques. The researchers also found exposure to microplastics could lead to increased mitochondrial reactive oxygen species in skin cancer cells, which in turn caused a change in mitochondrial membrane potential and ultimately resulted in skin cancer cell proliferation. The authors also evaluated the effect of microplastics on HaCaT**[2]** cells in a normal skin cell model. Their evaluation demonstrated that microplastics caused damage to normal skin cells through inflammation and cell scorch death. The authors study results suggested that microplastics may promote tumor cell proliferation and may cause damage to normal skin. The full article highlighted a limitation of the results, which was the study's focus on the toxicological effects of microplastics on skin cells and skin cancer cells in vitro models versus in vivo. **Read the full abstract**: https://www.sciencedirect.com/science/article/pii/S0147651323011405

[1] The MTT assay (MTT is a yellow tetrazole, a class of synthetic organic heterocyclic compound) is used to measure cellular metabolic activity as an indicator of cell viability, proliferation and cytotoxicity. This colorimetric assay is based on the reduction of a yellow tetrazolium salt (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide or MTT) to purple formazan crystals by metabolically active cells. https://www.sigmaaldrich.com/US/en/technical-documents/protocol/cell-culture-and-cell-culture-analysis/cell-counting-and-health-analysis/cell-proliferation-kit-i-mtt

[2] HaCaT is a spontaneously transformed aneuploid immortal keratinocyte cell line from adult human skin**,** widely used in scientific research. HaCaT cells are utilized for their high capacity to differentiate and proliferate in vitro.

MICROPLASTICS POLLUTION REDUCTION

Zapping Plastic Waste Can Produce Clean Fuel: Can Waste Plastic can be Converted into Hydrogen Gas

and a type of Graphene—at a Profit? December 1, 2023

Rebecca Sohn

This article described a method, developed by researchers in Rice University, which would generate hydrogen gas—a carbon-free energy source that can be burned in place of fossil fuels. The process breaks down chemical bonds in plastics and generates graphene—an extremely valuable, ultrathin carbon material used in products such as electronics, concrete and car parts. In 2020, the research team began testing this method, called flash Joule heating, which entailed using a strong electric current to heat plastic to about 2,700 degrees Celsius for mere milliseconds. At the time of this first study, the team observed the technique also released a gas which, after further analysis, was found to be up to 94% pure hydrogen. These recent study results have been published in *Advanced Materials*. In this new study, the researchers found that flash Joule heating could generate 39 to 84% fewer greenhouse emissions than other hydrogen-production methods. The method was found to be effective when using mixed plastic waste and it could also theoretically work for other carbon-based household garbage, such as cardboard and paper. The article asserted using that hydrogen on a large scale to fuel cars, power plants and other systems could reduce greenhouse gas emissions but would require fundamental changes to the entire energy infrastructure. **Read the full article here:** https://www.scientificamerican.com/article/zapping-plastic-waste-can-produce-clean-fuel/