The Rapids

US EPA's Trash Free Waters Monthly Update
December 2021

epa.gov/trash-free-waters

Introduction

Hello all,

Happy Holidays! On December 1st, the National Academy of Sciences Committee on United States Contributions to Global Ocean Plastic Waste published a long-awaited report entitled "**Reckoning with the U.S. Role in Global Ocean Plastic Waste**." This study evaluates U.S. contributions to global ocean plastic waste, assesses prevalence of marine debris and mismanaged plastic waste, examines the import and export of plastic waste to and from the U.S., and assesses the potential value of a national marine debris monitoring system. In addition, the committee develops knowledge gaps and recommends potential means to reduce U.S. contributions to global ocean plastic waste.

I also wanted to bring your attention to a recently published report produced by the Global Initiative Against Transnational Organized Crime, "**Plastic for Profit: Tracing Illicit Plastic Waste Flows, Supply Chains and Actors**." The resource offers an overview of the legal frameworks and supply chain processes related to transnational illicit trade in plastic waste as well as recommendations for reducing the risks associated with it.

Please continue to share any upcoming events with Layne Marshall (**marshall.layne@epa.gov**) so that the Trash Free Waters team can advertise these opportunities with all of you on the first Monday of each month.

Thanks,
Romell Nandi
US EPA
Trash Free Waters National Program Lead

EPA Announcements

EPA's National Recycling Strategy Published
On National Recycling Day, EPA announced the release of the National Recycling Strategy: Part One of a Series on Building a Circular Economy for All, which identifies actions to create a stronger, more resilient, and cost-effective domestic recycling system. The strategy serves as a roadmap for how the U.S. aims to achieve a 50% recycling rate by 2030.

EPA Announces Holistic Approach to Address Water Pollution from the Tijuana River Watershed
Congress appropriated $300 million for infrastructure to address transborder pollution in 2020 through the U.S.–Mexico–Canada Agreement (USMCA). On November 8, EPA Assistant Administrator for Water, Radhika Fox, announced EPA is initiating environmental review of a river trash boom, among a

suite of other water infrastructure projects with a high potential to stem transborder pollution and improve water quality.

EPA Awards $230,000+ for Recycling and Food Waste Prevention Projects in Midwest
On November 10, EPA announced four grants totaling $230,856 to fund projects in Illinois, Michigan, and Ohio to prevent wasted food and divert waste from landfills. Recipients include: University of Illinois at Chicago, Make Food Not Waste, the Michigan Recycling Coalition, and the Center for Ecotechnology in Ohio.

America Recycles Day
In honor of #AmericaRecyclesDay, EPA Administrator Michael Reagan challenged the public to recycle more and recycle right.

EPA Awards $40,000 in Funding to Denver, Colorado and Park City, Utah Projects to Reduce Source Pollution
On November 15, EPA announced $40,000 in funding to Center for EcoTechnology (CET) and Park City Municipal Corporation (PCMC) through the Sustainable Materials Management program. This funding will help connect Denver, CO with wasted food solutions to improve food waste reduction and recovery and pilot a reusable to-go container system in Park City, UT.

$2.8 Million in Grants Awarded to Improve the Health of Long Island Sound
On December 6, EPA, the National Fish and Wildlife Foundation, the U.S. Fish and Wildlife Service, the Connecticut Department of Energy and Environmental Protection, and others announced 22 grants totaling $2.8 million to state and local governments, nonprofit organizations, and community groups to improve the health and ecosystem of Long Island Sound in the States of Connecticut and Vermont. The projects are expected to remove 97,700 pounds of marine debris from the Sound and restore 25 acres of critical habitat for fish and wildlife.

Funding Opportunities

EPA Environmental Education Local Grants Program
Under the Environmental Education Grants Program, EPA seeks grant applications from eligible applicants to support environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. Applications must address at least one of the EPA's Educational Priorities and one of the Administrator's Environmental Priorities to be considered eligible. EPA will award three to four grants in each of EPA's 10 regions, for no less than $50,000 and no more than $100,000 each, for a total of 30-35 grants nationwide. **All applications must be submitted via grants.gov by December 6, 2021.**

The PADI AWARE Mission Hub Community Grants
PADI AWARE Foundation is open to funding non-profit ocean conservation related organizations and/or PADI Dive Centers. Funding cycle "0121" grants will be awarded to ocean protection initiatives and projects that directly advance the PADI Blueprint for Ocean Action, in direct support of the United Nations Decade of Science for Sustainable Development. Marine debris is one of 5 potential focus areas. All potential applicants will be required to complete an initial Eligibility Quiz. If your organization meets the requirements of the Eligibility Quiz you will be sent an email with a link to the application. **Applications are due by December 17, 2021.**

USDA Solid Waste Management Grant Program

The Solid Waste Management Grant Program was established to: Evaluate current landfill conditions to determine threats to water resources; help communities reduce the solid waste stream; and/or provide technical assistance and/or training to enhance operator skills or educate operators of landfills which are closed or will be closed in the near future with the development and implementation of closure plans, future land use plans, safety and maintenance planning, and closure scheduling within permit requirements. **The deadline for submissions is December 31, 2021.**

Other opportunities...

Take Care of Texas Student Video Contest

The Take Care of Texas Video Contest is a fun way for young people to learn about protecting the environment and come up with creative ways to share this knowledge with others. Students film a 30-second video that shows positive ways to Take Care of Texas. The students that submit the best videos can win great prizes, awarded by the contest sponsor, Waste Management of Texas, Inc. Students residing in Texas and enrolled in the 6th through 12th grade can participate. **Entries must be uploaded on or before 4PM Central Time (CT) on December 3, 2021.**

World of 7 Billion Student Video Competition

Through the World of 7 Billion student video contest, hosted by Population Connection, middle and high schoolers are given the platform to think critically about global challenges related to population and share what they think we should do to fix it. Each entry must focus on one of following global challenges as it relates to population growth: Ocean Health, Urbanization, or Agriculture and Food. The maximum video length is 60 seconds. **The deadline for submissions is 5PM ET February 22, 2022.**

EPA Environmental Justice Video Challenge for Students

EPA and partners have launched the Environmental Justice Video Challenge for Students to enhance communities' capacity to address environmental and public health inequities. The goals of the challenge are to: Inspire students at accredited colleges and universities in the U.S. and its territories to work directly with communities in the identification and characterization of EJ challenges using data and publicly available tools and help communities address EJ challenges and/or vulnerabilities to environmental and public health hazards using data and publicly available tools. Video submissions should be less than 6 minutes in length. **Submissions are due April 1, 2022.**

Kellogg-Morgan Stanley Sustainable Investing Challenge

Teams of graduate students from around the world are invited to develop and pitch creative financial approaches to tackle pressing social and environmental challenges through this competition. Plastic waste is specifically mentioned as a potential project focus. A total of 414 students from 87 schools across 50 countries competed last year. The first-place winner will receive $10,000. **Project prospectuses are due February 13, 2022.**

EPA's "Companies Crushing Pollution" Video Challenge

The "Companies Crushing Pollution" Video Challenge invites students and others including people who live near industrial facilities to create videos illustrating how businesses in the U.S. are reducing toxic chemical releases through innovative pollution prevention (P2) practices, and by having a positive impact on the environment and communities. Participants have a chance to win up to $5,000. On December 15, 2021, EPA will host a webinar to discuss challenge logistics and rules. **All videos must be submitted by March 1, 2022.**

Upcoming Events

Making Media Work for You, Your Campaigns and Your Ocean Advocacy
December 7th, 2021 (3-6PM ET)
The Sierra Club Marine Team is partnering with Blue Frontier to bring you a very exciting media training workshop designed to engage, mobilize, and broaden your effectiveness in communicating key issues that can protect and restore our world. You will learn creative approaches to pitching stories and storytelling, content storyboarding, as well as media distribution opportunities and strategies, brought to you by esteemed journalists and writers.

Microplastics From Food and Water Webinar
December 8th, 2021 (10AM- 12:30PM ET)
The National Academies of Sciences, Engineering, and Medicine (NASEM) Food Forum is hosting this meeting to review the state of the science and research gaps related to plastics and microplastics. Invited speakers include representatives from state government, industry, academia, and research institutes. Presenters will look at methods of detection and identification of microplastics in food and water, evaluating human health risks, and the policy and regulatory implications.

Gulf of Mexico Alliance 2021-2025: New Governors' Action Plan IV and Data Portal
December 8th, 2021 (3PM ET)
The Gulf of Mexico Alliance has released the Governors' Action Plan IV for Healthy and Resilient Coasts, signed by the governors of all five Gulf states. This collaborative workplan identifies priority issues, focus areas, and actions to enhance the environmental and economic health of the Gulf of Mexico. Presenters Dave Reed and Laura Bowie of the Gulf of Mexico Alliance will discuss new Action Plan commitments to strengthening community resilience, increasing regional data sharing, serving underrepresented communities, and improving management of coastal habitats and wildlife species.

Sierra Club: Plastics in the Ocean Webinar
December 8th, 2021 (7PM ET)
The Sierra Club Marine Team's upcoming webinar on marine plastics will feature Emmy-winning director and producer for the Story of Plastic, Stiv Wilson; Co-founder of the Plastic Pollution Coalition and environmental attorney, Lisa Kaas Boyle; Executive Director of the Plastic Ocean Project, Bonnie Monteleone, and Rutgers University Professor of Biological Sciences, Judith S. Weis.

The Climate Consequences of Plastics
December 9th, 2021 (1PM ET)
The Environmental and Energy Study Institute (EESI) invites you to join us for a briefing series about the climate impacts of producing building materials, plastics, and food. Panelists in this session will discuss findings from Beyond Plastics' new report, "The New Coal: Plastics and Climate Change"; how emissions associated with plastic production affect communities across the country; and potential policy solutions.

National Zero Waste Virtual Conference
December 8-9th, 2021
The National Zero Waste Conference is the annual two-day virtual educational and networking event organized by Zero Waste USA in partnership with the National Recycling Coalition. Zero Waste Business will be the focus on Wednesday, December 8 and Zero Waste Communities on Thursday, December 9. The conference will feature local, national, and international experts discussing Zero Waste and high diversion best practices and latest developments.

Virginia Stormwater & Litter Workshop

December 9th, 2021 (10AM -3:30PM ET)
The annual Virginia Stormwater and Litter Workshop for stormwater/MS4 and litter-prevention professionals is coordinated by Clean Virginia Waterways of Longwood University. The workshop will address urban trash pollution and strategies employed to intercept a piece of trash before it becomes part of stormwater runoff and is conveyed to and through the storm sewer system. We will share ideas through case studies, networking, and discussions and address funding, behavioral changes, legislation, and more.

"Entangled in Costa Rica" – Special Screening and Discussion with the Filmmaker and Local Scientists
December 9th, 2021 (1PM ET)
"Entangled in Costa Rica" will take you under the waters of the Eastern Tropical Pacific where Innoceana is working to put an end to the brutal and costly net entanglement crisis. In the screening and following discussion, you'll learn how they leverage citizen science, animal rescue, and growing public pressure for policy change to put a stop to the entanglement crisis and achieve an expanded marine protected area.

Addressing Racism as a Public Health Issue Through the Lens of Environmental Health Disparities and Environmental Justice
December 10th, 2021 (9AM– 4:45PM ET)
This National Institute of Environmental Health Sciences (NIEHS) workshop will foster dialogue among NIEHS employees, outside researchers, and members of the community to examine racism as a public health issue. The workshop seeks to: 1) Raise awareness of the problem of systemic racism in America and its contributing role to Environmental Health Disparities (EHD); 2) Inform participants of current EHD research and outreach activities in Environmental Justice; and 3) Engage regional and local community leaders involved in EJ advocacy networks to discuss best practices for community engagement.

Pinniped Entanglement Prevention and Response Workshop - Sharing Best Practices to Improve Safety and Success
December 12th, 2021 (8:30AM-5:30PM ET)
This in-person workshop will be held in advance of The Society for Marine Mammalogy 24th Biennial Conference on the Biology of Marine Mammals in Palm Beach, FL. The event is intended to bring together pinniped researchers, managers, and practitioners interested in reducing global pinniped entanglements and interactions with active fishing gear. Attendance preference will be given to those registered for the conference and non-conference registrants will have to pay a non-registrant participant surcharge.

APEC Workshop on Nanoplastics in Marine Debris
December 13-14th, 2021
The Asia-Pacific Economic Co-operation (APEC) workshop on "Nanoplastics in Marine Debris" aims to explore, share and progress micro and nanoplastics implications and mitigation research. The workshop will facilitate the sharing of best practices for characterization, understanding fate/transport, exposure, risk assessment, human and ecological health implications, and mitigation and remediation of micro- and nanoplastics in APEC economies. Interested parties are invited to come together to participate and learn from each other's experiences, share information and ideas on ongoing and planned projects, and develop plans for leveraged international efforts to address these global issues across the APEC region.

Solutions to Plastic Pollution: Prioritizing Reuse
December 14th, 2021 (2-3:30PM ET)
The Virginia Plastic Pollution Prevention Network is excited to present this 90-minute event, featuring speakers from several U.S. re-use organizations: Miriam Gordon of Upstream Solutions, Jennifer Congdon of Beyond Plastics, and Grace Lee of ReThink Disposables. The panel discussion will cover

Prioritizing Reduce/ Reuse over Plastics Bans and Prioritizing Source Reduction in Policy with a focus on Virginia.

Community and Citizen Science: Making Your Data Count
December 15th, 2021 (3PM ET)
This EPA Tools & Resources Webinar will explore how community and citizen science can contribute to environmental decision-making. This webinar will showcase community-oriented projects and share ideas from the workshop. Please attend this webinar to learn about the tools and practices used in these exciting community and citizen science projects and how EPA, states, and tribal governments can better support these efforts.

The Next Generation of Foodware Policies: Encouraging Safer Food Packaging and Reusable Foodware
December 16th, 2021 (2:30PM ET)
Upstream has teamed up with the Safer States network to develop more comprehensive foodware reduction policies designed to help us move towards non-toxic reusables and phase out the most problematic chemicals and materials from disposable food packaging. Miriam Gordon from Upstream and Renée Sharp from Safer States will present their shared vision and showcase why it's important to consider the role of toxic chemicals during the transition to reusables – including an overview of High Priority Chemicals and Materials to eliminate from food packaging and foodware - both disposable and reusable.

Save the dates for future months...

Ocean Plastic Virtual Summit
January 25-26th, 2022 (7AM- 1PM ET)
Ocean Plastic virtual summit 2022 is a new free event created to bring together the emerging ocean plastic industry, to learn, network, and discuss tackling the issue of valuable plastics escaping into the environment. Speakers from Asia, Europe, and the Americas will present on topics such as: Multi-stakeholder global supply chains, Traceability and certification, Governance and financing, Offsetting and plastic credits, and Collection and processing technologies.

Global Waste Management Symposium
February 14-17th, 2022
North America's #1 technical conference for research and case studies on waste management will include world-class content, state-of-the-art breakthrough research, solutions for big challenges, networking opportunities, and innovative presentations. The conference will feature sessions on waste characterization, solid waste planning, environmental justice, recycling, and more.

Plastics Recycling Conference 2022
March 7-9th, 2022
The Association of Plastic Recyclers hosts this gathering of plastics recycling and sustainability professionals, bringing together more than 2,000 industry decision makers for networking and discussion of key trends annually.

EWRI Operation & Maintenance of Stormwater Control Measures
March 13-16th, 2022
The Environmental & Water Resources Institute of the American Society of Civil Engineers is hosting a conference where attendees can learn from national leaders in green and gray stormwater infrastructure, including design for maintenance, O&M training programs, new maintenance approaches, advances in

municipal program management and implementation, life cycle analysis, and lessons learned from the field.

State of Lake Erie Conference (SOLE22)
March 16 -18th, 2022
Cleveland, OH (virtual participation may become possible)
Hosted by the International Association for Great Lakes Research, this conference will feature two days of concurrent sessions, plenaries, field trips, and discussions. The series promotes collaborations between the science and policy communities—particularly lake-specific research, management, education, and nonprofit organizations—to broaden the discussion and provide diverse interaction among stakeholders.

In case you missed it...

Data Collection and Monitoring for Trash-Free Waterways
EPA's Trash Free Waters Program hosted the sixth webinar of the series in late September. The event examined the benefits and challenges associated with litter data collection and monitoring. Speakers from the NYC Department of Environmental Protection, Keep America Beautiful, and the Ocean Conservancy provided local, national, and global perspectives on methods for collecting and analyzing trash data and the major challenges for obtaining and utilizing data.

The New Coal: Plastics & Climate Change
A webinar featuring Judith Enck, President of Beyond Plastics and Jim Vallette, President of Material Research and lead author of "The New Coal: Plastics and Climate Change" report.

Data Transparency and Grassroots Action to Close the Loop on Plastic Waste in China
This webinar was hosted by the Wilson Center in mid-November. The first speaker was Ma Jun, founder of Institute of Public and Environmental Affairs (IPE) and Wilson Center Global Fellow. IPE and the Vanke Foundation developed the Waste Map Project, which helps residents find the nearest collection and recycling stations and enables cities and companies to post information on their waste generation. The second speaker, Mao Da, founder of the China Zero Waste Alliance, discusses innovative corporate and policy campaigns to reduce plastic waste from e-commerce and food delivery.

Why Reuse Always Wins
This event, produced by Shedd Aquarium, was originally held as part of their Plastic Free July webinar series. Experts during this webinar discussed the various human health, environmental, and economic benefits associated with using reusables (especially in the food service industry) as our society combats the negative impacts of plastic production and pollution. Download the file to access the full webinar.

2021 Corporate Plastic Packaging Pollution Scorecard
During this webinar, expert guest panelists discussed As You Sow's Corporate Plastic Pollution Scorecard 2021, which ranks 50 companies in the fast food, consumer products, and retail sectors on key aspects of packaging sustainability, assessing leaders and laggards and cutting-edge actions.

The Climate Footprint of Plastics: Search for Solutions in Asia, Europe, and the U.S.
At this China Environment Forum, speakers delved into market changes, policies, lawsuits and technologies critical to reducing virgin plastic resin and plastic waste. Presenters included Carroll Muffett, President and CEO of the Center for International Environmental Law; Von Hernandez, Global Coordinator for Break Free From Plastic; and Alice Mah, Professor of Sociology at the University of Warwick.

Recent Legislation

Infrastructure Investment and Jobs Act
The Infrastructure Investment and Jobs Act was signed into law by President Biden on November 15. This is the single largest investment in U.S. water infrastructure and calls for $350 million+ in Solid Waste and Recycling Grants among other key focus areas. Following the passage of this act, the EPA will be making significant investments in the health, equity, and resilience of American communities.

The Microplastics Breakdown

HUMAN EXPOSURE TO MICROPLASTICS

Impact of Microplastics in Human Health A Focus on the Gastrointestinal Tract
Elora Fournier, Lucie Etienne-Mesmin, Stéphanie Blanquet-Diot and Muriel Mercier-Bonin
The premise of this chapter in "Handbook of Microplastics in the Environment" is that plastics used for packaged goods, including foodstuff, pose a potential threat to human health and focuses on the human gastrointestinal tract as a portal of entry but also first barrier and target for microplastics (MPs). The chapter includes a summary of the current state of the science on human oral exposure to MPs and the characteristics of ingested forms. The physicochemical transformations of MPs during digestion are discussed, including details about their potential effects on gut homeostasis, for example, disrupting gut microbiota, mucus and epithelial barriers. Both in vitro and in vivo studies using rodents were reviewed. Future research directions about MPs in the field of human intestinal health were identified. The authors highlighted the need to develop robust in vitro gut models to adequately simulate human digestive physiology for better gut health risk assessment and management of MPs.

Microplastics from Food Packaging: An Overview of Human Consumption, Health Threats, And Alternative Solutions
Ekta B. Jadhav, Mahipal Singh Sankhla, Rouf Ahmad, Bhat, D.S.Bhagat
This article discussed human exposure to MPs in plastic food packaging, specifically, the release of MPs from plastic packaging materials into food and drinks and the factors influencing their release. It also provides an overview of the alternatives to plastic packaging and aid to overcome the direct consumption of MPs with safe food packaging. The authors noted that the consumption of such plastic particles damages the human systems and impairs the normal metabolism processes. They also observed that it is impossible to conclude that the quality of MPs found in food and beverages is exactly similar to the quality of plastic packaging material due to the chances of environmental or external contamination during the manufacturing process or transport of packaged food and bottled water. The major factors that were identified as influencing the flaking and release of MPs from the body, wall, cap, and sealing film of plastic packaging material included: 1) the age of packaging material – highly used or recycled or reusable plastic packing releases more MPs than newly manufactured or low aged plastic packaging; and 2) high temperature – this damages the packaging body, which eventually releases high levels of MPs into food. Regarding plastic alternatives, the authors observed that the accidental consumption of natural polysaccharide, lipid, protein-based bioplastic packaging material is not as toxic as MPs released from plastic packaging; and that they are safer than currently used plastic polymers.

EFFECTS OF MICROPLASTICS EXPOSURE

Abstract 9880: Microplastics Exposure Promotes Cardiovascular Disease Risk in Mice
Jingjing Zhao, Daniel C Gomes, Daniel Conklin, Timothy E O'Toole

Based on their finding that prior studies suggested exposure to MPs induces oxidative stress and inflammation, since these outcomes also underlie cardiovascular disease (CVD), the authors sought to determine if ingestion of MPs promotes cardiovascular disease risk. They used an experimental approach in which groups of 13-week-old male mice were exposed to drinking water containing varying levels of polystyrene (PS) beads for 12 weeks. Several indices of pre-clinical CVD were measured periodically during the study. A statistically significant increase in body weight (fat mass) was observed in those mice consuming 0.5 μm polystyrene beads at a dose of 1 μg/ml as early as 3 weeks after initiation of treatment and maintained for the duration of the study. These mice were also found to have an increased fasting blood glucose fasting plasma insulin, and Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) scores. Study results suggest that polystyrene exposure promotes adiposity and insulin resistance and is a risk factor for atherosclerosis development and CVD.

Acute and Subacute Repeated Oral Toxicity Study of Fragmented Microplastics in Sprague-Dawley Rats

Jinsik Kim, Muthuchamy Maruthupandy, Kyu Sup An, Kwang Hun Lee, Soyeon JeonbJi-SuKim, Wan-Seob Cho

This study was conducted with the goal of aiding in the understanding of the effects of polypropylene (PP), the second most highly produced plastic worldwide, on human health. The authors prepared weathered PP (w-PP) MPs by sieving the MP particles after fragmentation and accelerated weathering processes. No chemical additives including phthalates and bisphenol A were found to be released during incubation. The w-PP samples were then gavaged to the rats; the highest dose was 25 mg/kg bw/day, which was determined to be the maximum feasible dose based on the dispersibility of MPs. Acute and subacute toxicity testings showed no adverse effects and mutagenicity. Thus, the authors concluded that the no observed adverse effect level (NOAEL) of w-PP MPs is higher than 25 mg/kg bw/day. The w-PP MPs did not show any skin or eye irritation potentials in the 3-dimensional reconstructed human skin or corneal culture model. The dose of 25 mg/kg of w-PP MPs is roughly equal to 2.82 × 105 particles/kg, which suggests that human exposure to w-PP MPs in a real-life situation may not have any adverse effects. The authors postulated that the non-toxic effects of w-PP MPs could be due to the absence or minimal absorption of particles through the gastrointestinal tract. The lack of the skin and eye irritation potential they thought could be due to the limited transmigration of w-PP particles across multiple keratin or cellular layers.

FATE AND TRANSPORT OF MICROPLASTICS

The Aging Behaviors and Release of Microplastics: A Review

Fugeng Zha, Mengxin Shanga, Zhuozhi Ouyang, Xuetao Guo

The authors described the purpose of their review of the current literature as to summarize: (1) the morphology and chemical characteristics, and mechanism of aging process of MPs; (2) the additives and intermediates from the release during the aging process, and to (3) evaluate the potential risks associated with aged MPs and their release into the environment. The article also described the characteristics of artificially aged MPs. Aged MPs were found to exhibit different morphological and chemical properties from pristine MPs and were found to be more easily absorbed by organisms and have different toxic effects from the pristine MPs. The authors observed that the existing literature indicates that the release of MPs is affected by environmental factors (e.g., Illumination, salinity, temperature and pH). Once MPs are discharged into the environment, they are subject to various environmental conditions – sunlight and thermal radiation, biodegradation, temperature fluctuation and physical abrasion – which accelerate the aging process. In soil, which is a porous medium with pore sizes mostly concentrated in the micron range, the MPs would migrate along the pores under the action of surface runoff, and the MPs may be worn away by mechanical forces in this process, which will accelerate natural aging. In the aquatic environment, floating part of the MPs was exposed to the sea, and the plastic fragments will be broken due to the loss of mechanical by the action of external shear force, tensile force and photolysis. The

authors concluded their review with an identification of research gaps which should be addressed to enable a better understanding of aging MPs and the release of toxic materials to environment and the potential impacts on organisms.

A Critical Review of Microplastics in the Soil-Plant System: Distribution, Uptake, Phytotoxicity and Prevention

Zhiqin Zhang, Qingliang Cui, Li Chen, Xiaozhen Zhu, Shuling Zhao, Chengjiao Duan, Xingchang Zhang, Danxia Song, Linchuan Fang

This review focused on the sources of MPs. The authors reviewed and considered the data collected from 116 studies. They summarized the state-of-art research on MPs in soil-plant system, including the source and distribution of soil MPs, plant uptake, phytotoxicity and detoxification, as well as potential mechanisms of how MPs affect plants and prevention strategies of soil MPs. The results demonstrated significant spatial variation in the global geographic distribution of MPs pollution and the concentrations of them differed by up to 6 orders of magnitude. Potential mechanisms for the uptake and effects on plants were identified: plants can sorb MPs from the soil through cracks of lateral roots, transportation, and finally accumulated in edible tissues, causing harmful effects on plants, such as delaying seed germination, inhibiting plant growth, suppressing photosynthesis, interfering with nutrient metabolism, causing oxidative damage, and producing genotoxicity. The authors found that some plants have evolved defense systems that effectively defended against the toxicity of MPs. This paper also laid out preventive strategies to mitigate soil MPs pollution and presented research gaps in the biogeochemical behavior of MPs in soil-plant systems.

Fate of Microplastics In Agricultural Soils Amended with Sewage Sludge: Is Surface Water Runoff A Relevant Environmental Pathway?

Theresa Schell, Rachel Hurley, Nina T. Buenaventura, Pedro V. Mauri̓ Luca Nizzetto, Andreu Rico, Marco Vighi

This study explored the fate of MPs in agricultural soils supplemented with sewage sludge and the role of surface water runoff as a mechanism driving their transfer to aquatic ecosystems. Three experimental plots located in a semi-arid area of Central Spain planted with barley were analyzed. The experimental plots received the following treatments: (1) control or no sludge application; (2) historical sludge application, five years prior to the experiment; and (3) sludge application at the beginning of the experiment. MPs were analyzed in surface water runoff and in different soil layers to investigate transport and infiltration for one year. Results indicate that sludge application significantly increases MP content in soils and that those concentrations remain relatively stable over time. Mobilization of MPs, both into deeper soil layers and along surface water runoff, was observed to be very low during the period of one year. Thus, the authors concluded that in semi-arid regions, surface water runoff has a negligible influence on the export of MPs from agricultural soils and that agricultural soils can be considered long-term MP accumulators.

If you'd like to see your posting in this email, please email Marshall.Layne@epa.gov with any suggestions!