ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 JANUARY 2021

The ESD Newsletter is a monthly newsletter involving ALL members of ESD. Members are encouraged to forward materials, authored papers on Environmental and Environmental Systems topics, and comments on newsletter topics or current events to the Editor. Your participation is greatly appreciated.

The ESD newsletter features **Five** Sections:
(Please use the **blue** links below to navigate within the newsletter)

1. ESD DIVISION NEWS

ESD Technical Representative to Waste Information Exchange Planning Committee – Volunteer Opportunity

The Environmental Systems Division (ESD), in conjunction with the ASME Materials and Energy Recovery Division, the ASME Research Committee on Energy, Environment and Waste, and the Air and Waste Management Association (A&WMA) are planning a Waste Information Exchange (WIE) in the Washington, DC area in 2022. The WIE will be based on the [Air] Information Exchange held annually in North Carolina. The main presenters will be EPA personnel.

ESD is looking for a volunteer to be the ESD Technical Representative to the Planning Committee. The individual should be familiar with the RCRA/HSWA regulatory program (including guidance and compliance/enforcement issues) on both solid and hazardous waste. Contacts in the Office of Resource Conservation and Recovery (ORCR) in DC would be a plus. Most of the work will be by telephone or electronic mail.

Submit a letter or email of interest to Arnie Feldman at jjdsenv@att.net or Ryan Neil, ESD Chair, at ryanneil84@hotmail.com **Back to Newsletter's Page 1**

Dixy Lee Ray Award Committee – Volunteer Opportunity

The Dixy Lee Ray Award Committee is looking for a volunteer to serve as a committee member. The Dixy Lee Ray Award is a prestigious ASME level award honoring those that have made a major impact in the environmental protection field. See https://www.asme.org/about-asme/honors-awards/achievement-awards/dixy-lee-ray-award for additional details.

Committee members' primary responsibility is to review nominations and select the annual Dixy Lee Ray Award winner. Committee members also help promote and publicize the award to their colleagues and friends. The committee normally meets thru conference calls and emails. Nominations are due to the committee by February 15 each year so most of the discussion and teleconference meetings occur February, March, and April. All committee members must be ASME members. The term of service is 5 years.

Submit a letter or email of interest to Ryan Neil, ESD Chair, at ryanneil84@hotmail.com.

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NEW ASME PLANT SYSTEMS DESIGN STANDARD

ASME has approved development of a new standard for Plant Systems Design (PSD). The charter is:
"To develop, review and maintain a technology neutral standard for design of plant systems for nuclear, fossil and petrochemical, chemical, and hazardous waste plants and facilities. The standard provides processes and procedures for design organizations to: (a) integrate process hazard analysis in the early stages of design; (b) incorporate and integrate existing systems engineering design processes, practices and tools with traditional architect engineering design processes, practices and tools; and (c) to integrate risk informed probabilistic design methodologies with traditional deterministic design. The focus is to provide requirements and guidance for design processes, methodologies and tools that will provide safer and more efficient system and component designs with quantified safety levels."
There are over 40 volunteers actively contributing to development of the Plant Systems Design standard. To create a truly technology neutral standard the Committee needs additional volunteers to add expertise and diversity for all types of plants and facilities that have significant health and safety risk to the worker and the public. The greatest applicability of this standard will be for new plant design. The focus is to reduce costs of new plant design and construction.

Please contact Ralph Hill at (hillr@asme.org) for more information or to join the PSD Committee.

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ASME ENERGY STORAGE COMMITTEE

The Energy Generation and Storage Technology Group (EGSTG) formed a new Energy Storage Committee (ESC) in the Spring of 2020. The ESC is dedicated to the advancement of energy storage systems: for both utility and distributed system. The focus of ESC extends across most of the other ASME Divisions and Sectors. This Committee works with government, industry, academia, ASME Codes & Standards, ASME Government Relations and other relevant professional and regulatory organizations to discuss, review, and promote practices which lead to the development, enhancement, and deployment of energy storage technologies.
The core values of ESC are to:

- Support international/intersociety professionals wishing to advance the application of energy storage thru basic research, applied research, development, and implementation
- Create and publish peer-reviewed high value content, reference documents
- Facilitate the creation, dissemination, and application of knowledge (science, engineering, technology) and information in energy storage within and outside ASME
- Attract students and young engineers into this area and provide them a forum to grow and advance their careers
- To encourage and facilitate a process for members to provide their expertise in the standards-setting process for energy storage
- To promote codes and standards for new areas energy storage
- To provide closer interface within and outside ASME through joint efforts/collaboration
- To help members keep pace with the latest developments

The main purposes of the Committee are fivefold:

- To develop and maintain the Energy Storage Matrix so that all (not only those on the Committee) know the status of the various technologies
- To develop standards (both ASME and IEEE as well as others) for energy storage: the Committee is a resource (e.g., people, volunteers, knowledge) for the various groups working on standards
- As central coordinating Committee (group) for sharing knowledge and answering questions on Energy Storage
- As a networking center for those directly (and indirectly) working on Energy Storage
- To develop events on Energy Storage such as webinars, forums and conferences

ESC members include engineers (and others) conducting research and practicing engineers in energy storage, storage equipment design, regulatory programs and the operations, design, maintenance, and testing of energy storage systems. Membership on the ESC is open to all ASME members, other professional society's (e.g., IEEE, AIChE, etc.), the governmental and regulatory community, and other interested individuals. Membership on the Committee is free to all. The intent is for the ESC to transition into an ASME Energy Storage Division in approximately one to two years. If you are interested in becoming a member of the Committee or need more information please contact Arnie Feldman, Chair, at (jjdsenv@att.net).

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RCEEW on PFAS Test Methods & Emissions

The ASME Research Committee on Energy, Environment and Waste (RCEEW) is forming a subcommittee to work on input into test methods and emissions for PFAS. If you want more information or are interested in serving on the subcommittee please contact Bob Hall at (bobhall27513@gmail.com).

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ASME Announces eight New Technology Groups

ASME has announced the formation of eight new Technology Groups. The Groups are: Digitalization Technology, Energy Sources and Processing, Bioengineering, Energy Generation and Storage Technology, Gas Turbine Technology, Space Systems, Humanitarian Engineering, and Robotics.

The groups were formed as part of the ASME restructuring of the Technical and Engineering Communities (TEC). The brief overview slides that describe the technical groups can be found at https://community.asme.org/technical_events_and_content_sector/w/wiki/10880.technology-groups.aspx. Members are encouraged to review the slides and reach out to the Group leads as noted in the presentations.

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2. ENVIRONMENTAL TECHNOLOGIES

Linking two enzymes turns plastic-eating bacteria into super-digesters

Plastic is everywhere. Scientists have found tiny bits of micro plastic even in the extremes of the Earth – from the deep-sea of the Mariana Trench to the peaks of the Pyrenees – and damaging life around us. While source reduction can be one of the most effective ways to reduce plastic waste, how do we deal with all of the plastic that already exists, polluting our oceans and overflowing out of landfills?

Polyethylene terephthalate, also known as PET and one of the most common types of plastic, is unfortunately notoriously difficult to break down. In 2016 however, scientists found a new species of bacteria outside of a bottle-recycling facility capable of decomposing plastic. The discovery revealed that the bacteria's abilities depend on two specific enzymes. These enzymes work together in a two-step process to break plastic down into smaller molecules that the bacteria can turn into energy. A new study published in the Proceedings of the National Academy of Sciences demonstrates a way to improve the two-enzyme system. While naturally existing as two separate enzymes – PETase and MHETase – the researchers physically linked them together. The attached enzymes worked together more efficiently than the same two enzymes when unlinked. Depending on the length of the linking segment between them, the attached enzymes were able to release almost double the amount or more of the final broken down product. With this process, PET, could be broken down by the bacteria in days, a process which would take hundreds of years in the environment. However, breaking down plastic only deals with part of the issue of plastic waste. Recovering the plastic waste already in the ocean and other corners of the planet to deliver to recycling or decomposing facilities remains a daunting challenge. In addition, even faced with the knowledge that we need to reduce plastic, the world has only been ramping up its production levels. Although these results are exciting, we are still far from solving our growing plastic problem. (Ref. 1)

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Can big data, AI and chemical foot printing help the renewable energy sector avoid a toxic waste legacy?

The launch of the digital economy has brought with it an expansion of disruptive technologies such as predictive analytics, artificial intelligence (AI) and robotics that are readily being used to transform the marketplace. However, can we also use these breakthrough technologies to accelerate the development of safer, more sustainable materials for the renewable energy sector? Starting with one of the fastest-growing clean energy sectors, solar technology, this is the fundamental question that a unique collaboratory is asking itself.

Three years ago, the Department of Materials Design and Innovation at the University at Buffalo, Clean Production Action (CPA) and Niagara Share created the Collaboratory for a Regenerative Economy (CoRE). CoRE recognizes the critical societal importance of scaling clean energy technologies such as solar to address the climate crisis. Nevertheless, to do this sustainably, we need to collectively scale solutions to reduce the use of toxic chemicals and scarce, unrecyclable materials that impede circular economies. Issues such as toxicity and

environmental impact are often an afterthought in the design phase, which is predominantly focused on improving the technical functions and efficiencies of materials. With more than 78 million tons of contaminated waste related to solar panels expected to hit landfills by 2050, this trend needs to be reversed. To improve the life-cycle footprint of solar panels, big data tools can help manufacturers embed human health and environmental criteria into the front end of the design phase of materials and products. In a recently released report, "Elements of Change: Moving forward together towards a cleaner safer future," CoRE outlines strategies for renewable energy companies to:

- Reduce chemical footprints of products, supply chains and manufacturing;
- Apply machine learning to design techniques for lead-free panels; and
- Use big data tools to rapidly characterize chemicals and identify safer solvents.

The development of high-performance materials typically takes decades, sometimes up to 30 years to commercialize a new material. Big data tools can organize the large volumes of disaggregated information companies need to improve the technical, environmental and social performance of materials. Solar companies that participate annually in the CPA Chemical Footprint Survey to measure their chemical footprint and track their performance against best practices, can leverage these tools to map patterns and impacts necessary for decision making and prioritization. For example, the use of lead in solar panels is problematic in the production and disposal of these products. Electronics companies have shown it is possible to design lead-free electronic products, but solar companies are still very dependent on lead-based technologies. This is true even with the next generation of solar panels — for example, perovskite-based solar panels show the potential to increase the efficiency of panels, but their chemistry is dependent on lead. (Ref. 2) **Back to Newsletter's Page 1**

3. ENVIRONMENTAL REGULATIONS

EPA Considers Approving Uses for Highly Toxic, Broadly Banned Pesticide on Citrus Crops

The U.S. Environmental Protection Agency (EPA) is contemplating the reapproval of toxic, widely banned insecticide aldicarb for use on citrus fruits in Texas and Florida. A vast amount of scientific evidence reports a dramatic decline in insect population (i.e., the insect apocalypse), like pollinators and other beneficial biotas, from environmental pollution sources like pesticides. Therefore, it is important to assess regulatory decisions that can potentially jeopardize the protection of these species and, consequently, human health. The fact that U.S. regulators would even consider expanding use of this dangerous, widely banned pesticide is a stunning indictment of our broken regulatory system. This application vividly reaffirms why the pesticide industry considers us the dumping ground for the world's worst pollutants. Aldicarb is a highly toxic, systemic carbamate insecticide, with initial production beginning in 1965. The chemical is a fast-acting cholinesterase inhibitor that permanently binds to the active site of an essential enzyme for normal nerve impulse transmission, acetylcholinesterase (AChE), deactivating the enzyme. In doing this, the chemical causes damage to the central and

peripheral nervous systems, interrupting neurological activity. Furthermore, exposure to high doses of aldicarb can cause vision problems, improper thermal regulation, headaches, nausea, and even death via polarization of the respiratory system. Thus, aldicarb is subject to regulation under the Rotterdam Convention, an international treaty established to reduce the trade of the most globally hazardous chemicals, with over 100 countries banning its use. Both EPA and the World Health Organization (WHO) classify the chemical in the highest toxicity category. However, the U.S. is one of only a few countries around the world that does not regulate aldicarb via the treaty, but merely strictly restricts its uses.

Although EPA restricts the use of aldicarb in households, the agency approves it for agricultural use on specific crops, including cotton, and beans by professional pesticide applicators. Hence, their use in agriculture poses a huge threat to environmental and human health via runoff. In fact, aldicarb was one of the first widely used pesticides to leach and contaminate groundwater in the Central Sand Plains of Wisconsin and Long Island, New York, during the early 1980s. Aldicarb may persist in groundwater for decades due to its long half-life between 200 to 2000 days and ingestion of aldicarb-contaminated groundwater by residents adversely affects immune system function (immune dysfunction). Furthermore, aldicarb is a systemic pesticide that plant roots and leaves readily uptake, leading to toxic chemical residues in pollen and sap-like droplets (guttation) easily accessible to vulnerable pollinators, like bees. (Ref. 3) **Back to Newsletter's Page 1**

FERC Adopts Expanded Definition of Cogeneration QFs to Include Certain Fuel Cell Systems

On December 17, 2020, the Federal Energy Regulatory Commission ("FERC") adopted a final rule ("Final Rule") regarding the potential for certain fuel cell systems to attain qualifying facility ("QF") status pursuant to Sections 201 and 210 of the Public Utility Regulatory Policies Act of 1978, as amended ("PURPA"). The Final Rule slightly amends the underlying proposed rule, issued on October 15, 2020 and discussed in greater detail here, in response to comments that the proposed rule would have applied to an overly-narrow subset of fuel cell technologies. In the Final Rule, the Commission approved a broad definition of fuel cell systems that may satisfy QF standards: "all fuel cells that use waste heat in an integrated fuel reforming process" may attain QF status as cogeneration QFs, as long as they satisfy other relevant QF requirements. PURPA provides for two categories of QFs: small power production facilities that rely on renewable energy input and are subject to size limitations and cogeneration facilities. PURPA directed the Commission to establish the criteria that would determine whether a particular facility qualifies as "cogeneration." The statute and FERC's earlier implementation of the statute defined a cogeneration QF as a facility that "produces (i) electric energy, and (ii) steam or forms of useful energy (such as heat) which are used for industrial, commercial, heating or cooling purposes." The Final Rule establishes that the hydrogen produced by fuel cell systems with an integrated hydrocarbon reformation process that produces electricity and hydrogen will be considered to be "useful thermal energy" for purposes of considering whether a facility produces useful energy used for industrial, commercial, heating or cooling purposes. Cogeneration facilities are subject to operating and efficiency standards and the owners of cogeneration QFs provide FERC with calculations demonstrating that the facility satisfies the standards. Subject to meeting other QF

requirements, such as satisfying operating and efficiency standards, facilities using such fuel cell systems to produce hydrogen and electricity used for industrial, commercial, heating or cooling purposes may be eligible for QF status. The Final Rule will allow the owners of certain fuel cell facilities to access a variety of benefits afforded to facilities with QF status. First, a QF's energy output may be "put" to the interconnected utility at the utility's avoided cost (unless the utility has been relieved of its PURPA purchase obligation). Second, the owners of QFs are subject to very light-handed regulation by FERC and are exempt from most FERC regulation even if they sell electricity at wholesale. Third, states lightly regulate the owners of QFs so QF status can relieve its owner of regulation at the state level. As an aside, FERC's rules implementing PURPA also apply to Electric Reliability Council of Texas (ERCOT), unlike many other FERC requirements. (Ref. 4) **Back to Newsletter's Page 1**

4. EDITORIAL BOARD SELECTIONS

Florida to Take Over Wetlands Permitting from Feds

The Trump administration last week made Florida the third state to assume control of the permitting process that determines what can be built in and around wetlands. Environmental Protection Agency Administrator Andrew Wheeler and state government leaders say the move gives Florida scientists with greater knowledge of local wetlands more control in the process. However, environmental groups counter that the state's environmental agency is not prepared for the responsibility and the move will result in acceleration of the state's wetland losses. Typically, to build around wetlands, developers must obtain both state and federal permits if they plan to dredge or fill in the area. The U.S. Army Corps of Engineers oversees this process for the federal government, determining whether construction projects like housing developments or utility projects will have a significant impact on wetlands, which provide shelter for animals and are vital in management of floodwaters.

With the change announced by the EPA, permitting authority under the Clean Water Act Section 404—which monitors the disposal of "dredge or fill material" into wetlands and other bodies of water—will now transfer from the Corps to the Florida Department of Environmental Protection. About one-fifth of the country's wetlands are in Florida, but the state has lost millions of acres of them in the past few decades. Dredging and filling for construction are a major source of loss, as Florida is one of the most active parts of the country for dredge and fill permits. Hundreds of Florida residents urged the EPA not to grant Florida's request to take over the permitting process. Many wrote to the federal agency saying they feared the state would be friendlier to developers, allowing construction in vulnerable landscapes. Major environmental groups like the Audubon Society, the state network of Waterkeeper organizations, and Earthjustice echoed those concerns. Florida is the first state in 25 years to receive approval to do the permitting process themselves. Michigan and New Jersey are the only two other states with such authority. The EPA said in a press release that state regulators are "generally more familiar with local aquatic resources, issues, and needs" and that a state-run program "can help reduce delays and save money for permit applicants."

Since 2018, the Trump administration has encouraged states to take over the 404 permitting process, but the transfer requires a complicated administrative process and is often controversial. Other states considering applying for this authority gave up. (Ref. 5) **Back to Newsletter's Page 1**

Liver tumor in gene therapy recipient raises concerns about virus widely used in treatment

Its troubling news that gene therapy researchers have long anticipated: A hemophilia patient injected with a virus carrying a therapeutic gene in a clinical trial has developed a liver tumor. The U.S. Food and Drug Administration (FDA) has halted the associated clinical trials, and uniQure, the Dutch firm behind the studies, is now investigating whether the virus itself caused the cancer. Gene therapy experts say that is unlikely. The patient had underlying conditions that predisposed him to liver cancer. Still, scientists say it is crucial to rule out any role for adeno-associated virus (AAV), the viral delivery system, or vector that is used in hundreds of other gene therapy trials. Gene therapy for various forms of the blood-clotting disorder hemophilia has been one of the field's latest success stories. UniQure's hemophilia B treatment appears to be among the treatments working, with 52 of 54 patients no longer needing injections of factor IX after 6 months in its latest study. But yesterday, uniQure revealed that an abdominal ultrasound done as part of its ongoing safety monitoring of trial participants found a liver mass in a patient treated in October 2019, prompting FDA to impose a hold on the company's three hemophilia trials. The news sent uniQure stock plunging, along with shares of other companies working on AAV gene therapy.

Still, there is reason to believe the virus did not cause the cancer. The patient was older, uniQure notes, and he had a liver disease that raises cancer risk. He also became infected with the hepatitis B and C viruses more than 25 years ago. Chronic infections of these viruses are linked to 80% of cases of hepatocellular carcinoma, the type of liver cancer found in the trial participant. But FDA and others are concerned because AAV vectors have produced cancer in mouse studies.

The AAV-delivered DNA normally forms a free-floating loop in the cell's nucleus. But studies in newborn mice have shown AAV can sometimes integrate its cargo into the recipient's chromosomes and cause liver cancer. Last year, researchers reported that several dogs treated with AAV for hemophilia A had foreign DNA in chromosome locations that apparently triggered rapid cell growth. But this was years after the dogs got the therapy, and the animals did not develop tumors. To find out whether that happened, uniQure will need to first confirm the tumor is cancerous with a biopsy, and then analyze cellular samples for genomic changes. The AAV could be implicated if the tumor is made up entirely of identical cells, or clones, that contain traces of the AAV's DNA cargo in the cells' genome near a growth or cancer gene. The AAV DNA would need to be found in the exact same site in all cells in the tumor. (Ref. 6) **Back to Newsletter's Page 1**

CRISPR helps researchers uncover how corals adjust to warming oceans

The CRISPR/Cas9 genome editing system can help scientists understand, and possibly

improve, how corals respond to the environmental stresses of climate change. Work by Carnegie's Department of Embryology details how the revolutionary, Nobel Prize-winning technology can be deployed to guide conservation efforts for fragile reef ecosystems. Their research team's findings were recently published in two papers in the Proceedings of the National Academy of Sciences. Corals are marine invertebrates that build extensive calcium carbonate skeletons from which reefs are constructed. But this architecture is only possible because of a mutually beneficial relationship between the coral and various species of single-celled algae that live inside individual coral cells. These algae convert the Sun's energy into food using a process called photosynthesis and they share some of the nutrients they produce with their coral hosts kind of like paying rent. Coral reefs have great ecological, economic, and aesthetic value. Many communities depend on them for food and tourism. However, human activity is putting strain on coral reefs including warming oceans, pollution, and acidification and that affects this symbiotic relationship.

In particular, increasing ocean temperatures can cause coral to lose their algae, a phenomenon called bleaching, because the coral takes on a ghostly white look in the absence of the algae's pigment. Without the nutrients provided by photosynthesis, the coral can die of starvation. In 2018, they demonstrated the first use of the CRISPR/Cas9 genome editing on coral. Now, the team used CRISPR/Cas9 to identify a gene responsible for regulating coral's response to heat stress. Working first in the anemone Aiptasia, one team -- including members from Stanford University's identified a protein, called Heat Shock Factor 1 (HSF1), which activates many genes associated with the response to heat stress. Anemones are close coral relatives that have similar symbiotic relationships with photosynthetic algae, but they grow faster and are easier to study. These traits make Aiptasia a powerful model system to study coral biology in the lab. Then another team from Queensland University of Technology and the Australian Institute of Marine Science (AIMS) used CRISPR/Cas9 to create mutations in the gene that encodes HSF1 in the coral Acropora millepora, demonstrating its importance for coping with a warming environment. Without a functioning HSF1 protein, the coral died rapidly when the surrounding water temperature increased. Understanding the genetic traits of heat tolerance of corals holds the key to understanding not only how corals will respond to climate change naturally but also balancing the benefits, opportunities and risks of novel management tools. (Ref. 7)

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Toxic waste dumping in the Gulf of Guinea amounts to environmental racism

Toxic waste and electronic waste (e-waste) is generated from a wide range of industries – such as health, hydrocarbon or manufacturing – and can come in many forms, such as sludge's or gas. E-waste is used electronic items that are nearing the end of their useful life, and are discarded or given to be recycled. If these types of waste are not properly discarded, they can cause serious harm to human health and the environment. This makes the proper disposal of toxic and e-waste expensive. Because of this, a market has been created and some companies and independent waste brokers circumvent laws. They disguise toxic waste as unharmful and e-waste as reusable electronics. It is then exported to countries in West and Central Africa where it is often disposed of unethically at dumpsites. Some African countries, Nigeria, Ghana, and Côte d'Ivoire do not have the facilities to enable the safe disposal of hazardous and toxic waste. In addition, the true contents of the waste are usually unknown to them. Exporters label

unsalvageable electronic goods as reusable. This allows them to circumvent international laws, which prohibit the transboundary transport of this waste. Drawing on examples from Côte d'Ivoire, Nigeria and Ghana, it is clear that toxic waste dumping in the Gulf of Guinea amounts to environmental racism. This is a term that is used to describe a form of systemic racism – manifested through policies or practices – whereby communities of colour are disproportionately burdened with health hazards through policies and practices that force them to live in proximity to sources of toxic waste.

The dumping of toxic waste into Africa, while deliberately concealing its true content, shows that companies know it is ethically wrong. To protect communities within these countries, governments must implement the provisions of the Basel and Bamako Conventions. These conventions classify the transboundary movement of hazardous waste without the consent of the receiving state as illegal. (Ref. 8) **Back to Newsletter's Page 1**

New Research Highlights Impacts of Weed killer on Wildlife

Prolonged exposure to environmentally relevant concentrations of the weed killer Roundup causes significant harm to keystone species, according to new research at the University of Birmingham. A team in the University's School of Biosciences used water fleas, or Daphnia, to test the effects of prolonged exposure to concentrations of Roundup deemed safe by regulatory agencies. They found that even at approved regulatory levels, the weed killer causes embryonic development failure, significant DNA damage, and interferes with the animals' metabolism and gut function. These findings are important since Daphnia are at the heart of aquatic food webs. They can be used to assess the impacts of environmental changes on ecosystems. The results also offer a starting point for tracking these effects across different species, including the potential effects of herbicides on humans.

Research surrounding Roundup has been controversial since it first appeared on the market in the 1970s. Claims that it causes diseases and disorders ranging from cancer to autism stack up against industry-paid reports arguing that the product has no untoward effects. The problem is that much of the evidence is rooted in outdated toxicity tests, which only look at the number of animals that die on exposure to extremely high concentrations of these chemicals. These tests also overlook the pathological effects arising from long-term exposure to low doses. Toxicity is measured by looking at what happens to the animal at a molecular and fitness level following long-term exposure, which encompasses the entire animal life cycle. This "systems biology" approach will enable researchers to understand the changes caused by these chemicals on fundamental functions, such as the ability to metabolize sugars or to repair wound tissue. By using similarity in molecular functions across species, the researchers can also infer the implications of these chemicals on humans.

The approach tested by the researchers can be applied to a wide number of chemicals in the environment. As well as herbicides, the team is applying their methods to investigate insecticides, anti-inflammatory drugs, antibiotics, and heavy metals (arsenic), commonly found in contaminated water supplies around the world. The team is working with the UK Environment Agency to bring new methods to regulatory agencies to screen for chemicals and their effect on biodiversity. Scientists and the Environment Agency have a long-term goal of

modernizing environmental practice to more effectively regulate the use of chemicals and mitigate their impact on humans and the environment. (Ref. 9) **Back to Newsletter's Page 1**

5. ESD NEWSLETTER READER COMMENTS

None received this month.

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NEWSLETTER ARTICLE REFERENCES

1 https://massivesci.com/notes/enzyme-linking-plastic-bacteria-pet/
2. https://www.greenbiz.com/article/can-big-data-ai-and-chemical-footprinting-help-renewable-energy-sector-avoid-toxic-waste
3. https://beyondpesticides.org/dailynewsblog/2020/12/epa-considers-approving-uses-for-highly-toxic-broadly-banned-pesticide-on-citrus-crops/
4. https://www.natlawreview.com/article/ferc-adopts-expanded-definition-cogeneration-qfs-to-include-certain-fuel-cell
5. https://www.route-fifty.com/management/2020/12/florida-wetland-permitting/170943/
6. https://www.sciencemag.org/news/2020/12/liver-tumor-gene-therapy-recipient-raises-concerns-about-virus-widely-used-treatment
7. https://www.sciencedaily.com/releases/2020/12/201221134146.htm
8. https://theconversation.com/toxic-waste-dumping-in-the-gulf-of-guinea-amounts-to-environmental-racism-148542

ABOUT NEWSLETTER

9. https://www.labmanager.com/news/new-research-highlights-impacts-of-weedkiller-on-wildlife-24675ENVIRONMENTAL ENGINEERING features the application of environmental technologies to engineering systems to attain optimal performance according to established standards. The Newsletter of the Environmental Systems Division (ESD) will attempt to highlight a variety of environmental technology applications aimed at enhancing engineering systems performances in accordance with the latest standards by presenting excerpts of and links to selected articles from a variety of websites.

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