ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 SEPTEMBER 2020

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:
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None received this month

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 2021. 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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ICEM 2021 Call for Abstracts

ASME, the Nuclear Engineering and the Environmental Systems Divisions, are pleased to announce the Call for Abstracts for the International Conference on Radioactive Waste Management and Environmental Remediation (ICEM). The Conference is set for October 10-13, 2021 in Stuttgart, Germany. ICEM promotes a broad global exchange of information on technologies, operations, management approaches, economics, and public policies in the critical areas of environmental remediation and radioactive waste management. The conference provides a unique opportunity to foster cooperation among specialists from

countries with mature environmental management programs and those from countries with emerging programs.

The program Tracks below are shown below. The associated Topics for each Track can be seen on the ICEM website (https://event.asme.org/ICEM/Program).

Abstracts are due January 18, 2021. Abstracts should be submitted on-line via the website at https://icem.secure-platform.com/a/organizations/main/home. For additional information on submitting abstracts, please contact ASME at toolboxhelp@asme.org.

For additional general information on ICEM or to volunteer to support (e.g., Session Chair) please contact either Arnie Feldman (jjdsenv@att.net) or Bob Stakenboroghs (bob@advclean-energy.com). **Back to Newsletter's Page 1**

2. ENVIRONMENTAL TECHNOLOGIES

Could This 'New' Coloured Cotton Technology Eliminate Toxic Dyes?

A group of scientists at CSIRO in Canberra, Australia has developed a method to grow cotton that has the potential to wipe out the need to dye the fabric by genetically modifying the fiber. Their experiments have 'cracked cotton's molecular color code' in order to diversify the crop from its natural off-white or the earthy green and brown hues of naturally colored cotton, into potentially every shade of the rainbow. In just a few months' time, they are hoping for their first harvest of brightly colored cotton fiber, revolutionizing Australia's $2 billion cotton industry by eliminating toxic dyes from the production process. The innovation comes at a moment when the environmental impact of textile dyes is at the crossroads. Mainstream dyeing techniques used extensively across the industry still use a lot of carcinogenic chemicals that threaten the health of factory workers. What's more, the irresponsible disposal of toxic waste from processing plants pollutes waterways that millions of people and animals rely on as their lifeblood, with nearly 20% of all water pollution originating from textile dyeing treatments. It's said that in some parts of China and India, local communities can predict the next big color trend in fashion by simply looking at the color of the river, which 2016 sustainable fashion documentary RiverBlue showcases in graphic detail. However, these colorful chemicals are just the tip of the iceberg. The true cost of color is arguably its water footprint. Unless waterless dye technology is used, approximately 200 tonnes of water is required to make just one tonne of fabric. Cotton is also already an incredibly thirsty fabric before it even reaches the dyeing stage, with around 10,000 liters used for every one kilogram of cotton. When used in denim production, intense dark shades like indigo and black are often regarded as the most polluting and resource-intensive colorants, so if cotton growth in fashion-friendly colors takes off, the industry's water consumption could take a much-needed nosedive. (Ref. 1) **Back to Newsletter's Page 1**

Feeding the Waste Cycle: How PFAS 'Disposal' Perpetuates Contamination

Current methods of managing waste from toxic "forever chemicals" do not work – and in fact, perpetuate the cycle of contamination, according to peer-reviewed research by scientists from the Environmental Working Group (EWG). In a study recently published in the journal Chemosphere, EWG scientists concluded that burning, discarding and flushing materials containing the toxic fluorinated chemicals known as PFAS do not effectively contain or destroy them but rather end up just returning either the same chemicals or their byproducts back into the environment. In other words, PFAS "disposal" is just another step in the contamination cycle. PFAS are used in hundreds of products, such as food packaging, clothing, carpets, and cookware, for their waterproofing or grease-proofing properties. PFAS chemicals suppress the immune system and are associated with cancer, reproductive and developmental harms, and reduced effectiveness of vaccines. Thousands of U.S. communities with PFAS contamination are urgently looking for treatment options, but every technology currently in use produces PFAS-laden waste. These disposal practices move PFAS among waste management sites and contaminate air, soil and water along the way. With current disposal options, the concentrated PFAS waste likely returns to the environment, to require costly removal once more. In addition, the changes made in the US in conjunction with USEPA states the following. "Certain PFAS chemicals are no longer manufactured in the United States as a result of phase outs including the PFOA Stewardship Program in which eight major chemical manufacturers agreed to eliminate the use of PFOA and PFOA-related chemicals in their products and as emissions from their facilities. Although PFOA and PFOS are no longer manufactured in the United States, they are still produced internationally and can be imported into the United States in consumer goods such as carpet, leather and apparel, textiles, paper and packaging, coatings, rubber and plastics". The EWG study examines the state of the science of three standard practices for PFAS waste management – incineration, landfilling and wastewater treatment – and makes recommendations for improved treatment practices and additional research. (Ref. 2) **Back to Newsletter's Page 1**

3. ENVIRONMENTAL REGULATIONS

What Does IRS, Treasury Carbon Capture Tax Credit Guidance Mean For Future Energy Production?

Recent Treasury releases gave taxpayers much-needed guidance in seeking to take advantage of tax credits under the Internal Revenue Code ("Code") Section 45Q for successfully capturing and removing from the atmosphere qualified carbon dioxide. There are two methods of sequestration of this gas rewarding the successful taxpayer (the owner of the sequestration equipment) as follows:

- For carbon dioxide that is placed in secure storage, a credit of between $22.66 and $50.00 per metric ton, otherwise,
- For carbon dioxide that is injected into the ground in an Enhanced Oil Recovery (EOR) process, a credit of between $12.83 and $35.00 per metric ton.

The allowable credit in each tax year is adjusted upward each year (for inflation) in a table set out in the regulations. Credits may be claimed in tax years through 2026, but only on construction beginning after February 9, 2018, and before January 1, 2024. In the event that sequestration is not maintained (absent relief under EPA SubPart RR for Class II wells or ANSI ISO 27916:19), credits are recaptured as increases to tax liability measured using a five-year look-back period. Carbon capture, utilization and storage ("CCUS") is the broad term used for a collection of technologies that remove carbon from the air (or combustion streams before burning) and either utilize it in another process or store it permanently in a manner that prevents it from entering the atmosphere. Most commonly, the focus is on removing carbon dioxide from flue gas streams and storing it underground.

The CCUS process involves three main steps and each employs a variety of technologies: capture, transportation, and storage. The nature of these technologies is that economies of scale are important to achieve commercial viability; therefore, the economics improve when they are deployed near large point sources of carbon dioxide generation.

In 2017, the Department of Energy ("DOE") instructed the National Petroleum Council ("NPC") to provide advice regarding the "actions needed to deploy commercial carbon capture, use, and storage (CCUS) technologies at scale into the U.S. energy and industrial marketplace." Their report, released in December 2019, included important observations regarding the regulatory, technical, and financial aspects of CCUS and its viability under the current regulatory scheme. (Ref. 3)

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EPA Finalizes New Rule and Rolls Back Existing Rules Regarding Methane Emissions in the Oil and Gas Industry

On Thursday, August 13, the EPA finalized new rules that rolled back Obama-era policies and standards that regulated methane emissions emanating from oil and gas facilities, including from well sites, compressor stations and processing, and other storage and transportation facilities. The rules concluded a process that began in 2018 and will apply to wells that have been drilled since 2016, removing requirements for producers to have systems to detect methane leaks and reducing the frequency for checks for leaks. These LDAR programs (as they are commonly referred to) were put in place by President Obama through the provisions of what is generally referred to as OOOO and OOOOa – air quality regulations developed by the EPA as a means of controlling methane emissions and in furtherance of his administration's larger climate change policy. Methane, while making up only 10% of greenhouse gas emissions in the United States, is a substantially more potent greenhouse gas than others. Further, the new rules provide for the use of alternative methods for limiting emissions and certain safe harbors for wells that are defined as low production oil and gas wells, while also retaining requirements related to semi-annual monitoring.

Also of import for the oil and gas industry, the new provisions will allow for averaging of the storage tank emission calculations from individual well sites. When the proposed rules were announced last year, the administration estimated the changes would save the oil and gas industry up to $19 million a year in compliance costs, which is of even greater importance today given the current market conditions in the energy sector. (Ref. 4)

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4. EDITORIAL BOARD SELECTIONS

Can Technology Make More Natural Pesticides?

If you ask two farmers what it really takes to bring healthy and affordable food to market, you will probably get four or five different answers. The reason: there are a thousand's of local variations in soil, weather, and farming practices, just as there are thousand's of natural forces working against a crop at any given time. Insects, weeds, and diseases evolve relentlessly to overcome whatever farmers throw at them. However, can nature's evolutionary bounty be harvested for solutions to these challenges, too? Zymergen, a bio manufacturing company at the forefront of synthetic biology, thinks so. Today, it announced a new partnership with agricultural sciences company FMC -0.2%FMC Corporation to develop new crop protection solutions to growers around the world. In combining the two companies' formidable discovery and development capabilities, the partners aim to build the world's best and fastest pipeline for bringing new natural products to growers.

FMC makes local solutions to local problems so farmers can make the most profitable use of their land. FMC understands what farmers need to protect their crops, and a key feature of the partnership involves searching Zymergen's vast molecular library—the largest metagenomic database in the world—to find natural products to do that. Historically, the challenge has been figuring out what these molecules have evolved to do. Zymergen has developed computational methods for predicting with high accuracy their likely utility, which includes protecting crops from pests. Serber says that predictive ability is going to cause a revolution in agriculture and beyond. FMC will provide criteria that reflect growers' most important needs for novel modes of action to manage resistance. These selection criteria will inform Zymergen's computational models and, in turn, speed discovery of higher-performing crop protection solutions based on nature. FMC can screen about 65,000 molecules a year in the lab. The most promising candidates graduate to small-scale testing with actual pests and actual weeds, before going all the way to greenhouse and field-testing. (Ref. 5)

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Low-Cost Second-Generation Ethanol Production Powered by Genetically Engineered Enzyme Cocktail

Brazilian researchers used genetic engineering to develop a low-cost platform for the production of enzymes that break down sugarcane trash and bagasse for conversion into biofuel. The novel molecules have many potential industrial applications. Researchers at the Brazilian Center for Research in Energy and Materials (CNPEM) have genetically engineered a fungus to produce a cocktail of enzymes that break down the carbohydrates in biomass, such as sugarcane trash (tops and leaves) and bagasse, into fermentable sugar for industrially efficient conversion into biofuel. The development of low-cost enzyme cocktails is one of the main challenges in producing second-generation ethanol. Second-generation biofuels are manufactured from various kinds of nonfood biomass, including agricultural residues, wood chips, and waste cooking oil. The CNPEM research group's process paves the way for optimized use of sugarcane residues to produce biofuels.

The fungus Trichoderma reesei is one of the most prolific producers of plant cell wall-degrading enzymes and is widely used in the biotechnology industry. To enhance its

productivity as a bio factory for the enzyme cocktail in question, the researchers introduced six genetic modifications into RUT-C30, a publicly available strain of the fungus. They patented the process and reported it in an article published in the journal Biotechnology for Biofuels. The fungus was rationally modified to maximize the production of these enzymes of biotechnological interest. Using the CRISPR/Cas9 gene-editing technique, they modified transcription factors to regulate the expression of genes associated with the enzymes, deleted proteases that caused problems with the stability of the enzyme cocktail and added important enzymes the fungus lacks in nature. As a result, they were able to allow the fungus to produce a large number of enzymes from agro industrial waste, a cheap and abundant feedstock in Brazil. Some 633 million tons of cane is processed per harvest in Brazil, annually generating 70 million metric tons of cane trash (dry mass), according to the National Food Supply Company (CONAB). This waste is underutilized for fuel ethanol production. (Ref. 6) **Back to Newsletter's Page 1**

Questioning the Role of Biosynthetics in Regenerative Fashion

Fibershed is honored to be featured in an important and newly published report: The Nature of Fashion: Moving towards a regenerative system by our colleagues and collaborators at the Biomimicry Institute. The paper defines and amplifies the work to physically manifest a model of textile production that: "boosts biodiversity, builds soil, supports communities, and cleans up existing pollution." The paper highlights nature's dynamic equilibrium and points to a broken link between primary production and decomposition. This disconnect has and continues to generate textile-based pollution, and the report shows how both virgin and recycled plastic sources of pollution disperse into the earth's biome. The paper challenges the industry to design for the reality of earth's dispersal processes, including a focus on decentralizing and co-locating textile production and decomposition systems. The writers lay out a suite of options, including regenerative agriculture—with a focus on integrated agricultural systems, and decentralized, regional production as key solutions. Currently, plastic fibers are positioned as the first choice in sustainability by many of the leading frameworks promoted by and for the textile industry. The Nature of Fashion logically upends this approach by embedding circularity within the earth's natural cycles and systems. This upending has been a long time coming. For years, many organizations, (including our own), have spoken to the dire issues of plastic fiber contamination that now exist in drinking water, high elevation snow packs, animal bodies, soils, and marine ecosystems. Yet we continue to see brands, including those most praised and publicly regarded for their environmental consciousness, use plastic fibers in their clothing lines. (Ref. 7) **Back to Newsletter's Page 1**

Oceans' plastic tide may be far larger than thought

The world's seas could be home to a vast reservoir of hitherto unidentified pollution; the growing burden of the oceans' plastic tide. Up to 21 million tonnes of tiny and invisible plastic fibers could be floating in the first 200 meters of the Atlantic Ocean alone. In addition, as British research exposed the scale of the problem, American chemists revealed that for the first time they had found microplastic fibers incorporated within human organ tissues. A day

or two later Dutch scientists demonstrated that plastic waste was not simply a passive hazard to marine life: experiments showed that polluting plastic released chemicals into the stomachs of seabirds. First, the global problem. Oceanographers have known for decades that plastic waste had found its way into the sea: floating on the surface, it has reached the beaches of the remote Antarctic, been sampled in Arctic waters, been identified in the sediments on the seafloor and been ingested by marine creatures, from the smallest to the whale family.
Ominously, researchers warn that the sheer mass of plastic waste could multiply threefold in the decades to come. Moreover, unlike all other forms of human pollution, plastic waste is here to stay, one day to form a permanent geological layer that will mark the Anthropocene era. Scientists report in the journal Nature Communications that at 12 places along a 10,000 km north-south voyage in the Atlantic late in 2015, the waters were sampled for evidence of just three forms of plastic litter: polyethylene, polypropylene, and polystyrene. These samples were taken at depths of 10 meters below the surface, between 10 and 30 meters below what oceanographers call the mixed layer, and then 100 meters even deeper. They then looked for fragments of the three plastics right down to the scale of 25 millionths of a metre and began counting. They found up to 7,000 particles of all three types in a cubic meter of seawater. Then they did the sums: people have been throwing plastic bags, packets, bottles, cups, nets and packaging away since 1950, and it has been getting into the Atlantic since 1950, with the estimated mass so far ranging from 17 million to 47 million tonnes. The Atlantic has an average depth of 3000 meters. The discovery that the mass of plastic just in the upper 200 meters of one ocean lies somewhere between 12 and 21 million tonnes suggests that the flow of plastic into the seas everywhere may have been seriously under-estimated. (Ref. 8)

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Surface clean-up technology won't solve ocean plastic problem

Clean-up devices that collect waste from the ocean surface will not solve the plastic pollution problem, a new study shows. Researchers compared estimates of the current and future plastic waste with the ability to float clean-up devices to collect it -- and found the impact of such devices was "very modest." However, river barriers could be more effective and -- though they have no impact on plastic already in the oceans -- they could reduce pollution "significantly" if used in tandem with surface clean-up technology. The study -- by the University of Exeter, the Leibniz Centre for Tropical Marine Research, the Leibniz Institute for Zoo and Wildlife Research, Jacobs University and Making Oceans Plastic Free -- focusses on floating plastic, as sunk waste is difficult or impossible to remove depending on size and location. The authors estimate that the amount of plastic reaching the ocean will peak in 2029, and surface plastic will hit more than 860,000 metric tonnes -- more than double the current estimated 399,000 -- by 2052 (when previous research suggested the rate of plastic pollution may finally reach zero).
The important message of this paper is that we cannot keep polluting the oceans and hoping that technology will tidy up the mess. "The other major solutions are to bury or burn it -- but burying could contaminate the ground and burning leads to extra CO2 emissions to the atmosphere." Private initiatives proposing to collect plastic from oceans and rivers have gained widespread attention recently. One such scheme, called the Ocean Cleanup, aims to clean the "Pacific garbage patch" in the next 20 years using 600m floating barriers to collect plastic for recycling or incineration on land. The new study analyzed the impact of deploying

200 such devices, running without downtime for 130 years -- from 2020 to 2150. In this scenario, global floating plastic debris would be reduced by 44,900 metric tonnes -just over 5% of the estimated global total by end of that period. (Ref. 9) **Back to Newsletter's Page 1**

5. ESD NEWSLETTER READER COMMENTS

None received this month.

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ESD NEWSLETTER BOARD

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NEWSLETTER ARTICLE REFERENCES

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ABOUT NEWSLETTER

ENVIRONMENTAL 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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