ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 JULY 2020

The ESD Newsletter is a monthly enterprise 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 in submitting materials for the newsletter is greatly appreciated.

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5. READER COMMENTS TO THE EDITOR
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 email. 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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ASME ESD Student/Early Career Competition Committee – Volunteer Opportunity

The ASME Environmental Systems Division (ESD) is organizing a new Environmental Student/Early Career Competition. The competition is envisioned to be between like age/education individuals or groups (e.g., classes, schools, etc.). The Competition Committee will split (for now) the competition into two groups (details below):

1. Grades K-12
2. College Students, Grad Students & Early Career

Grades K-12 Sub-Committee

- Sub-Committee will develop questions/issues/topics (Competition) for each of the three school levels
    - Elementary
    - Middle/Jr High
    - High
- Guidelines for responses to be developed by Sub-Committee with assistance from ASME staff

  - Format
  - Expectations
- Timing is to send out the Competition early in 2021
  - Competition format needed by Dec 15, 2020
- ASME K-12 will advertise/disseminate the Competition to school officials & teachers
  - Responses due back to ASME by April 1
- Sub-Committee members (and others) to be judges

College Students, Grad Students & Early Career Sub-Committee

- Sub-Committee will use in conjunction with ASME staff the ASME eFEST and EFX to disseminate competition
- Sub-Committee will develop questions/issues/topics (Competition) for each of the three school levels
  - College Students
  - Graduate Students
  - Early Career
- Guidelines for responses to be developed by Sub-Committee with assistance from ASME staff
  - Format
  - Expectations
- The Competition should be at a level commensurate with education (for grad students and early career similar to FE questions)
- Timing is to send out the Competition in fall of 2020
  - Competition format, including questions, needed by August 1, 2020
- ASME will advertise/disseminate the Competition to thru eFEST/EFX
  - Responses due back to ASME by December 15, 2020
- Sub-Committee members (and others) to be judges

Submit a letter or email of interest to Arnie Feldman at jjdsenv@att.net.

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ICEM 2021 ANNOUNCEMENT, Call for Volunteers

ASME, the Nuclear Engineering and the Environmental Systems Divisions, are pleased to announce the return of the International Conference on Radioactive Waste Management and Environmental Remediation (ICEM). The Conference is set for October 10-13, 2021, in Stuttgart, Germany. As with past, ICEM's the Conference will feature Plenary and Luncheon speakers, breakout sessions, and a large exhibit hall suitable for equipment displays for radioactive D/D&D tasks. The breakout sessions will feature panel discussions, invited speakers, articles, and presentations, as well as peer-reviewed papers.

The Tracks for ICEM 2021 include:
Track 1: Robotics and Remote Handling and Viewing Technologies
Track 2: Facility Decommissioning, Decontamination & Demolition (D/D&D) Overall (Plan, Decommissioning, Demolition, R&D)
Track 3: Major facilities experience in handling accidents and D/D&D
Track 4: Spent Fuel, Fissile Material, TRU, and HLW Management:
Track 5: L/ILW Radioactive Waste Management:
Track 6: Environmental Remediation (ER) including Activities at NORM/TENORM Sites
Track 7: Special Topics 1 - Public Involvement/ Crosscutting Issues/Global Partnering/Human Resource Development
Track 8: Special Topics 2 – New Facility Planning/ Environmental Management (EM)/ Health & Safety
Track 9: Student/Young Engineers Program
Track 10: D/D&D Research & Development Activities

If you are interested in being a Track Chair, a Session Chair, or helping to develop the conference, please contact Arnie Feldman (jjdsenv@att.net) or Bob Stakenboroghs (bob@evisive.com). **Back to Newsletter's Page 1**

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

A new approach to CO_2 capture

MIT researchers have demonstrated a system that promises to capture carbon dioxide (CO_2) in various exhaust streams—from power plants to home furnaces—and even retrieve it from ambient air. At the core of their device is an electrode made of a material that grabs CO_2 when the material is negatively charged and releases it the instant that charge goes away. In the device, small changes in voltage activate the electrode to capture CO_2 from a passing gas stream and then release it into a subsequent stream as pure CO_2 for industrial use or disposal. Tests show that the small, simple system is durable and efficient at targeting any level of CO_2 in any volume of exhaust. The researchers plan to develop a pilot-scale plant within a few years.

Some power plants have CO_2 capture equipment that grabs CO_2 out of their exhaust. However, those systems are each the size of a chemical plant, cost hundreds of millions of dollars, require a lot of energy to run, and work only on exhaust streams that contain high concentrations of CO_2. They are not a viable solution for airplanes, home heating systems, or automobiles. Developing a technology that can capture the CO_2 in the air is a difficult problem, in part because the CO_2 occurs in such low concentrations. A key challenge with CO_2 capture is finding a "sorbent" that will pick up CO_2 in a stream of gas and then release it so the sorbent is clean and ready for reuse and the released CO_2 stream can be utilized or sent to a sequestration site for long-term storage. Research has mainly focused on sorbent materials present as small particles whose surfaces contain "active sites" that capture CO_2—a process called adsorption. When the system temperature is lowered (or pressure increased), CO_2 adheres to the particle surfaces. When the temperature is raised (or pressure reduced), the CO_2 is released. Nevertheless, achieving those temperature or pressure "swings" takes considerable energy, in part, because it requires treating the whole mixture, not just the CO_2-bearing sorbent. Using electricity to elicit the chemical reactions needed for CO_2 capture and conversion has been studied for several decades, but researchers now have a new idea about how to engineer a more efficient adsorption device. Their work focuses on a special class of molecules called quinones. When quinone molecules are forced to take on extra electrons—, which means they are negatively charged—they have a high chemical affinity for CO_2 molecules and snag any that pass. When the extra electrons are removed from the quinone molecules, the quinone's chemical affinity for CO_2 instantly disappears, and the molecules release the captured CO_2. (Ref. 1) **Back to Newsletter's Page 1**

The Revolutionary Tech That's Turning Waste Into Energy

The $150-billion organic food industry has a fertilizer problem that could hinder its growth. Massive livestock operations from Europe to North America have an even bigger problem: They are producing large volumes of polluting waste they have nowhere to put, and it is a damage-control cost they have to deal with. The solution to both will have to come from the tech world, and that crossroads of opportunity where farming, fertilizer, and low carbon energy could finally meet. One answer very well may come from a Canadian junior called EarthRenew, which is now preparing to highlight a new, patented technology that helps solve both of these problems, while generating its own electricity along the way for added revenue. The patented technology turns livestock waste--a critical environmental problem--into a new organic fertilizer that hopes to change the game for the flourishing, $150-billion organic farming industry.

EarthRenew also plans to use the waste heat from its electricity production using natural gas to generate more electricity. That electricity is then used in its own fertilizer operations, with the surplus sold to the grid for an additional revenue stream. In January 2020, EarthRenew earned USD $100,000 just selling natural gas fired power to Alberta's grid. That makes this a low-cost operation: They are producing their own electricity, and most of the raw material for their patented new fertilizer process is free since EarthRenew's processing plant at Strathmore, in Calgary, sits on a 25,000-head cattle farm. EarthRenew's tech solutions are all about modularity. That means they can provide livestock operators with their own scalable facilities to turn a their expensive manure problem into an electricity-generating cost-saver. Filling the fertilizer gap is the key to solving multiple energy and farming problems, and EarthRenew's patented, low-cost production process is being created to do just that. EarthRenew's Strathmore Plant will produce heat-treated organic fertilizer that is superior to the composted manure common in the market, with better nutrients. The company's thermal treatment is set not only to drive off the unwanted contaminants but will also be richer in the key nutrients as well as being a slow-release compound. Because EarthRenew's product will be sold in pellet form, it can be applied to the land when needed, not just during the spring and fall months when manure can be applied. It means flexibility for farmers. (Ref. 2)

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3. ENVIRONMENTAL REGULATIONS

Evaluating the Costs and Benefits of Environmental Regulations

On June 11, 2020 the Environmental Protection Agency issued a Notice of Proposed Rulemaking for a rule that would preclude the agency from counting indirectly-regulated benefits, known as co-benefits or ancillary benefits, in its cost-benefit analyses The proposed rule is inconsistent with several of the current administration's major rulemaking efforts and goes further than most the industry requested.

The proposed rule is contrary to the fundamental economic principle that actions, including government regulations, are appropriate and desirable where benefits — regardless of their source — outweigh costs.

The use of cost-benefit analyses by federal agencies in the rulemaking process was mandated by an executive order issued by Ronald Reagan in 1981. At the time, industry welcomed the order as a check on inefficient and overly burdensome environmental regulations. As benefits have become capable of being quantified with more certainty due to improved air monitoring (particularly of fine particulate matter, or PM2.5, which causes respiratory and cardiac ailments), the cost-benefit analysis no longer allows regulated entities to challenge regulations. Guidance (circular A-4) from the Office of Management and Budget (OMB) directs agencies to consider benefits that are "unrelated or secondary to the statutory purpose of the rulemaking (e.g., reduced refinery emissions due to more stringent fuel economy standards for light trucks)," and to "look beyond the direct benefits and direct costs of your rulemaking and consider any important ancillary benefits and countervailing risks." For several recent rulemakings, the benefits associated with reducing PM2.5 have by themselves exceeded the costs of complying with air regulations aimed at other pollutants. For example, the Obama administration estimated that by 2030 the Clean Power Plan would have provided $34 billion to $54 billion per year in total benefits, including $20 billion in direct benefits and $14 billion to $34 billion in co-benefits, at an annual cost of $8.4 billion. (Ref. 3) **Back to Newsletter's Page 1**

A Challenge to EPA's Enforcement and Compliance Assurance Program in the Wake of COVID-19

On March 26, 2020, the U.S. Environmental Protection Agency ("EPA") issued a memorandum loosening enforcement for non-compliance of certain environmental laws and regulations because of the COVID-19 pandemic. The EPA indicated that while entities should make every effort to comply with environmental compliance obligations, if compliance is not reasonably practical as a result of burdens caused by COVID-19, such entities should attempt to "act responsibly under the circumstances in order to minimize the effects and duration of any non-compliance caused by COVID-19," and "return to compliance as soon as possible."

Because of this relaxation of environmental laws, several states have challenged the EPA. Lead by New York, a coalition of nine state attorney generals filed suit in the Southern District of New York seeking to block any entities from taking advantage of the EPA policy. The gravamen of the argument is that the policy exceeds the EPA's statutory authority, is arbitrary and capricious, and issued without complying with legal notice and comment requirements. The lawsuit also alleges that EPA "abdicates EPA's statutory duties to protect public health and the environment." (Ref. 4) **Back to Newsletter's Page 1**

4. EDITORIAL BOARD SELECTIONS

USDA relaxed its GMO, gene-edited crop rules—but not enough to foster biotech innovation

The USDA recently published its revision of the rule Movement of Certain Genetically Engineered Organisms, newly dubbed "SECURE," which deregulates some plants with genetic changes made using new gene editing techniques like CRISPR. Both SECURE's supporters in industry and its anti-GMO opponents agree that it represents a fundamental shift in regulation, either praising it for encouraging innovation or criticizing it for "letting companies regulate themselves." Genetic engineering currently helps in reducing the environmental impacts of agriculture — Bt insecticide-producing crops have reduced insecticide use as well as crop loss due to pest damage, and increased insect biodiversity in fields — and gene editing has even greater potential. However, in order to maximize this potential, one should break free from the longstanding approach of regulation tied to the method of genetic engineering, which SECURE perpetuates, and embrace an approach based on the actual risks posed by the genetically engineered plant. In one sense, SECURE does make a vast departure from the past 30 years of USDA regulation of genetically engineered plants. Historically, the USDA has regulated all genetically engineered (GE) plants for plant pest risk, and it made the process of bringing a first-generation GMO plant to market expensive and time-consuming — partially by requiring extensive data from developers to deregulate any GE plant. For crops introduced between 2008 and 2012, the entire process took an average of $136 million and 20 years, with $35 million and 7 years devoted solely to meeting regulatory requirements. (Ref. 5) **Back to Newsletter's Page 1**

Environmental Group perspective on chemical recycling

In a new report, the Global Alliance for Incinerator Alternatives (GAIA) reviews chemical recycling methods for plastic recycling, such as pyrolysis and depolymerization, which have been embraced by the chemical and oil industries. The environmental group contends that chemical recycling poses environmental hazards and is not technologically feasible at a large enough scale to solve the plastic waste problem. Many chemical companies promote chemical recycling as an alternative to mechanical recycling. For mechanical recycling, which is based on sorting and washing plastics, attaining purity and properties similar to virgin materials is challenging. Chemical recycling schemes, recover the original raw materials.

The report states: "While such a solution may seem ideal, sound engineering practice or common sense shows that chemical recycling is not the answer to society's problem of plastic waste,". "It represents a dangerous distraction from the need for governments to ban single-use and unnecessary plastic, while simultaneously locking society into a 'business as usual' future of more oil and gas consumption." Among its critiques of chemical recycling, the report says pyrolysis can produce dangerous by-products such as toxic polycyclic aromatic hydrocarbons. The chemical recycling processes, the report points out, also require massive amounts of energy to transform waste into plastics again. The report says that a lack of research on chemical recycling allows it to be "portrayed above and well beyond its capabilities."(Ref. 6) **Back to Newsletter's Page 1**

Hydroponics - The Eco-Friendly Future of Farming?

Hydroponics is spoken about in almost reverent tones by researchers. Farmers are fearful of the revolution it represents — tearing up their traditional practices — but with it comes the promise of ever-higher yields. So not only could it solve the problem of feeding our ever-growing population, but as a buy-product, it could dramatically reduce farming's environmental impact, which has a long record creating land, water and air pollution . This makes hydroponics promising emerging technologies.

Hydroponics is the rowing plants without soil. A seed is placed into a damp substrate to germinate. The substrate can be shredded coconut mass, foam, or even a porous material like terracotta. It just needs to have a surface the roots can grip to. Once the seed has germinated, the substrate is transferred to the hydroponics system where the growth occurs. The roots are submerged in nutrient-rich water and artificial light often provided. Plant can then grow quickly as all of its water, nutrients and light needs are met perfectly, 24/7. There are many variations of hydroponics. The thing, which separates them, is how the water is transferred around the system, and where the nutrients come from. One type getting a lot of attention is vertical farming. In vertical farming, shelves of plants have nutrient-rich water pumped across them. They also have lights set at a specific wavelength, providing specific amounts of energy, tailored to the specific type of plant they are, and tailor to the specific stage of growth. (Ref. 7) **Back to Newsletter's Page 1**

Tailor-made climate-ready and nutrient-dense rice

The world population is projected to increase to nearly 10 billion in the year 2050. We will not only need 56% more calories but also high nutrient foods to feed the future population. Predicted increasing average air temperatures and uneven precipitation will not only limit productivity and acreage of rice production, but also nutrient density in rice production in the tropics. The situation is worse when the prevalence of non-communicable disease NCD is rapidly increasing to become a global threat in modern-day and beyond. The cause could be the overconsumption of simple, processed carbohydrate foods in young and elderly populations.

To mitigate the future food shortage, genetic improvements should consider multiple goals to increase yield potential, resistance to biotic and abiotic stresses and nutritional quality. Consuming high caloric foods over an optimum daily caloric intake is a major cause of obesity and NCD therefore. Rice for wellbeing combines functional properties of starch, dietary fiber, prebiotic, antioxidant, nutrients, and micronutrients that can lower the risks of NCDs. Whole grains; in particular, pigmented rice fits all categories of the rice for wellbeing. Dietary fiber-rich whole grain rice prolongs hunger, allowing consumers to optimize their dairy caloric intake more efficiently. Specific dietary fibers help control the glucose spike of meal intake, resulting in a low glycemic index (GI), and consequently, a low risk of obesity and Type 2 diabetes. In addition, it provides essential nutrients to enrich microbiota in your gastrointestinal tract that helps in enhancing your immune system against infectious and non-infectious disease such as diarrhea, irritable bowel syndrome (IBS), inflammable bowel disorder (IBD), and colon cancer, etc. Therefore, breeding for attractive whole grain rice is the most sensible goal of breeding rice for wellbeing. Rice for wellbeing must be cultivated in eco-friendly practices such as organic, pesticide-free, low carbon/water footprints. However,

current rice production technologies depend on high such production inputs like herbicides, inorganic fertilizers, and pesticides, which leave toxic chemical, and heavy metal residues such as Cd and As in rice grains. As such, rice for wellbeing must be equipped with multiple resistances to diseases and insect pests. We have developed a breeding platform to effectively integrate all genes (QTLs) controlling multiple resistance/tolerance to 2-weeks flash flooding (F), and multiple resistance to bacterial leaf blight (B), leaf/neck blast (B), and brown planthopper (B). Now, nine existing cultivated Thai rice cultivars were successfully improved with the FBBB, enabling farmers for pesticide-free cultivation and food safety products. The most notable example is the newly improved variety called the Thai Jasmine Rice Plus 4 which can readily withstand the biotic and abiotic stresses along with the Jasmine rice grain quality1. (Ref. 8)

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New waste-to-hydrogen processes could add to a carbon negative future

As more U.S. states pursue aggressive greenhouse gas and waste reduction goals these problems should be looked at as interconnected systems. Using promising next-generation technologies that have not yet been scaled up and utilized to their full potential can help address climate change, waste issues and air quality. The growth of unrecyclable plastics, and an increase in the use of facemasks and other personal protective gear amid the COVID-19 crisis, calls for new, sustainable disposal strategies. Sustainable disposal of medical waste – as doctors and dentists' offices reopen, and elective medical procedures come back – should also be a priority. Converting solid waste into hydrogen is a key technology that can greatly reduce emissions, scientists at Lawrence Livermore National Laboratory concluded in a recent report. If carbon capture and storage is added, according to that report, advanced waste-to-hydrogen technology can produce negative emissions.

Carbon negative strategies like these are critical for governments to reach their emissions reduction goals and for the world to transition to net zero-carbon and limit global warming to 1.5 degrees Celsius above pre-industrial levels, according to the Intergovernmental Panel on Climate Change (IPCC). The waste industry can benefit from advanced waste-to-hydrogen technologies to expand its toolbox of waste processing options, expand capacity and increase sustainability, especially for streams that may face logistical challenges. Waste-to-hydrogen technology is commercially available today in the United States and multiple other countries. Next-generation thermochemical processes convert solid waste – including plastics, medical waste, municipal solid waste and wastewater sludge – into hydrogen without incinerating the waste. The carbon dioxide produced during the process – which is equal to the amount of carbon in the waste feedstock – can be easily captured and stored or utilized to make new products using technology that is commercially available today, at costs that are continuing to fall. Existing renewable energy sources such as solar and wind power, and battery-electric vehicles will not be enough to decarbonize the world economy, Bloomberg New Energy Finance recently concluded. Hydrogen is a "clean molecule" that is versatile, reactive, storable, transportable, clean burning and can be produced with low or zero emissions to help the world transition from fossil fuels, according to the report. (Ref. 9)

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5. ESD NEWSLETTER READER COMMENTS

None received this month.

Expecting the reader's comments and views on the newsletter.

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ESD NEWSLETTER BOARD

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NEWSLETTER ARTICLE REFERENCES

1 http://energy.mit.edu/news/a-new-approach-to-co2-capture/
2. https://oilprice.com/Energy/Energy-General/The-Revolutionary-Tech-Thats-Turning-Waste-Into-Energy.html?mc_cid=47afb6b66d&mc_eid=86f6b380fd
3. https://www.niskanencenter.org/evaluating-the-costs-and-benefits-of-environmental-regulations/
4. https://www.jdsupra.com/legalnews/a-challenge-to-epa-s-enforcement-and-76531/
5. https://geneticliteracyproject.org/2020/06/11/viewpoint-usda-relaxed-its-gmo-gene-edited-crop-rules-but-not-enough-to-foster-biotech-innovation/
6. https://cen.acs.org/environment/recycling/Environmental-Group-critical-chemical-recycling/98/web/2020/06
7. https://medium.com/predict/hydroponics-the-eco-friendly-future-of-farming-16fa1f0dd12
8. https://www.openaccessgovernment.org/rice-varieties/89064/
9. https://www.wastedive.com/news/opinion-waste-to-hydrogen-carbon-negative-future/578695/

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.

DISCLAIMER

Disclaimer: This newsletter may contain articles that offer differing points or views. Any opinions expressed in this publication do not represent the positions of the ESD Executive Board members or the American Society of Mechanical Engineers (ASME).