



# ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 FEBRUARY 2020

This ESD Newsletter is a monthly enterprise involving ALL members of ESD. ESD Members are encouraged to forward materials, authored papers for publishing on Environmental Engineering 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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# 1. ENVIRONMENTAL TECHNOLOGIES

## Novel technology uses sunlight to degrade toxic liquid waste

Scientists have developed an efficient, economical, and environment-friendly technology that uses sunlight to degrade toxic liquid waste, an advance they say could significantly reduce the waste-management costs of industries. The technology, developed by the researchers from Lovely Professional University (LPU) in Punjab, India, involves photocatalytic degradation -- a chemical reaction that involves the absorption of light -- using nanoparticles as catalysts. The technique is extremely efficient for the degradation of toxic organic chemicals produced by companies across sectors like pharmaceuticals, textiles, pesticides, paper, paints, and other chemical industries, according to the study published in the Asian



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Journal of Chemistry. Liquid waste management is a major challenge for many industries globally, especially those in the manufacturing space, owing to the extensive use of chemicals, the researchers said. These industries produce several kinds of liquid wastes which can cause serious environmental damage, like water and soil pollution, ground water contamination, and landfill contamination, if not treated properly, they said. The researchers noted that a huge amount of liquid waste is produced in India due to the presence of a large number of industries. They noted that the country's Central Pollution Control Board (CPCB) has set standards and guidelines regarding disposal of liquid waste. However, because of the high cost, most of the industries do not follow the proper waste management techniques to prevent the pollution caused by hazardous waste, they said. Currently, the industry spends about INR 120 to degrade one litre of liquid waste, according to the researchers. (Ref. 1)

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## **Water and wastewater treatment technologies market to grow at a CAGR of 9.00% by 2023**

Declining Freshwater Resources to Boost the Demand, Fresh water, even though abundantly available, is a limited resource to humanity in the environment. The increasing need for mechanization and food safety have led to the excessive use of the available freshwater resources in the past century, without taking efforts to replenish them. This has created an ecological imbalance, as the wastewater produced from agriculture, industrial processes, and sewage was discarded into freshwater resources. Currently, freshwater sources have become polluted largely due to human activity and some have even become toxic. Also, there have been reports of fires in the lakes, owing to chemical waste disposal.

Water treatment applications have been increasing lately, owing to the strong demand for freshwater resources. Water recycling is a multi-stage process in wastewater treatment plants. The primary treatment of water involves the removal of sediments and other high-density particles in the water that tend to settle down. The technique majorly employed for this process is sedimentation. Water is collected in huge tanks and is allowed to settle down for hours to days depending on the processing procedure. Then secondary treatment of the water is performed where the majority of the biological content of the water is removed. The tertiary stage involves the removal of other harmful dissolved chemicals and disinfection. Secondary treatment in wastewater is a major part of the process, where a majority of the biological content has to be processed to reduce the load on the tertiary processing stage. Moving-bed-biofilm reactors are used at this stage. They have proven to be an effective solution with a minimal land requirement. Owing to the increased emphasis on environmental protection, concerned government authorities and environmental organization are enacting wastewater discharge standards for all the end-user industries. Therefore, to abide by these regulations, industries are adopting different wastewater treatment technologies, such as reverse osmosis, membrane bioreactors, and ultra-filtration, combined with water and wastewater treatment chemicals, for converting wastewater into reusable water. (Ref. 2) **[Back to Newsletter's Page 1](#)**



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## 2. ENVIRONMENTAL REGULATIONS

### **Streamlining environmental regulations doesn't have to endanger the environment**

The US administration sparked controversy in January when it announced plans to alter the way environmental reviews are conducted for new building projects. Much of the reaction has focused on the move as a straightforward rollback of environmental protections, but the truth is more complicated. The federal government's current environmental review practices do need serious reform, but if the reforms are not carefully designed, they could prove pointless. At issue is the National Environmental Policy Act, (NEPA) Enacted 50 years ago as part of the first major wave of environmental legislation, the law was intended to force federal agencies to minimize the environmental harms of their own infrastructure projects (such as highway construction) and take these harms into account in federal land management and permitting decisions. To ensure that federal agencies did not simply give lip service to these considerations, the law also included several "action-forcing" provisions requiring agencies to follow certain procedures, produce written environmental impact statements and justifications of their decisions, and allow private parties the ability to sue if they felt the agency's analyses were incomplete or procedurally flawed. If courts ultimately agreed, the suing parties could recover their attorney's fees. Reducing the government's environmental harms is a worthwhile goal. Today, however, NEPA has grown into something far beyond what was originally anticipated. When NEPA was passed, it was expected that the required impact statements would be short (no more than 150 pages) and quick (taking no longer than a year to complete). But over the years, the length of the analyses has grown, and the time it takes to complete them has multiplied. (Ref. 3) [Back to Newsletter's Page 1](#)

### **Hold Your Water – Navigating the new rule defining “Waters of the United States”**

On January 23, 2020, the Department of the Army Corps of Engineers and the U.S. Environmental Protection Agency finalized a rule redefining the scope of federal regulatory jurisdiction over “waters of the United States.” The federal Clean Water Act, 33 U.S.C., §§1251, et seq., prohibits the discharge of any “pollutant” (including not only traditional contaminants but also dredge spoils, rock, and sand) into “waters of the United States” without a permit. Almost since it was enacted in 1972, the scope of federal jurisdiction under the Act has been confusing and controversial, primarily because of the vague statutory language. The agencies have revised the definition a number of times, and the agencies' interpretations have invariably been challenged in court as being either too narrow or too broad. Along the way, the United States Supreme Court has addressed the issue directly in at least three decisions, two of which overturned prior agency interpretations on the basis that they expanded jurisdiction beyond what Congress intended or the Constitution allowed. Over the years, the definition and the attendant regulatory requirements have been a trap for unwary property owners and developers working in wetlands, sometimes far from navigable waters, or even on dry land impacted only occasionally by ephemeral waters. The definition



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in the new rule is a significant departure from the 2015 rule proposed by the Obama administration, which had been intended to provide clarity and certainty, but required detailed, specialized studies and evaluations to assess and, if necessary, mitigate impacts to wetlands. The 2015 rule was challenged immediately and enjoined by the courts until it was finally repealed in 2019 by the Trump administration. The new rule also purports to provide clarity and certainty, but it does so by significantly narrowing the scope of coverage and eliminating numeric tests and standards. The stated purpose of the new rule is to reduce federal overreach, allowing states to decide questions about land use and environmental protection for areas that do not have a direct connection to interstate waters. Like its predecessors, the new rule will undoubtedly be challenged immediately in the courts, after it is published in the Federal Register. (Ref. 4) [Back to Newsletter's Page 1](#)

## 3. ESD CHAIRMAN/DIVISION NEWS

### ESD Events Committee

**Why:** The ESD Executive Committee has formed a new ESD Events Committee (EC) to coordinate and oversee ESD's participation in the various Events (i.e., Conferences, Workshops, Training Sessions, Webinar's, Forums, etc.). The EC will promote ESD's goals by sponsoring technical sessions within ASME and sponsoring/cosponsoring (with other professional societies and organizations) events including technical sessions, leading events, developing events and participating in events. The selection of sponsored sessions with ASME will be determined by the EC with input from the Executive Committee and from the ESD's membership. The EC will recommend to the Executive Committee co-sponsorship with other organizations of technical sessions of interest to the ESD membership. The EC will coordinate all event activities for ESD and will report to the Executive Committee.

**How:** The EC is looking for volunteers to join our Committee. The Exec Committee is NOT asking that you participate in any additional events (unless you want to) but are asking you to serve on the EC. The Events Committee will require a minimal amount of your time and will be conducted only by conference calls (no travel) - probably bi-monthly - and through emails.

**Submit Nominations:** please contact Arnie Feldman at 267-880-2325 or [jjdsenv@att.net](mailto:jjdsenv@att.net)

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## ICEM 2021 ANNOUNCEMENT

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 Oct 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 do not hesitate to contact Arnie Feldman ([jjdsenv@att.net](mailto:jjdsenv@att.net)) or Bob Stakenboroghs ([bob@evisive.com](mailto:bob@evisive.com)). **[Back to Newsletter's Page 1](#)**

## 4. EDITORIAL BOARD SELECTIONS

### DOSSIER: Confronting the global rubbish crisis

For years, China was the go-to destination for exporting the West's refuse material. But with an import ban now in place for everything from plastics to e-waste, and a growing global population producing an ever-greater amount of rubbish, what exactly is the future for a world awash with garbage? China's ban on 'foreign garbage', specifically 56 varieties of solid waste, ranging from plastics to textiles and electrical items, has exposed an uncomfortable and dirty truth behind the West's efforts to reduce, reuse and recycle its waste. Loading cardboard, plastic film and pots, tubs and trays and other garbage onto ships and sailing it overseas has, to date, enabled us to avoid addressing the issue in a meaningful way at home.

Until its ban, China imported around 45 per cent of the waste the world produced; in 2016 alone that figure was seven million tonnes. The repercussions have floated, rather like



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nurdles on an ocean current, all the way back to the United Kingdom. 'China's "green fence" has changed the dynamics of the global market and that's the biggest difficulty affecting the UK,' says Simon Ellin chief executive of the Recycling Association. 'China wasn't too bothered about the quality [of waste] it was being sent. The US, EU, UK and Australia were sending them everything and anything.' As if to reinforce Ellin's point, in September 2019 the British waste management firm, Biffa, was fined £350,000 by the UK courts for trying to ship household rubbish to China labelled as waste-paper fit for recycling but which included sanitary towels, nappies, wet wipes and condoms. (Ref. 5) [Back to Newsletter's Page 1](#)

### Potency Assays for Cell and Gene Therapy

Approved biological products are required to be accompanied by analytical tests to demonstrate safety, purity and potency. Manufacturing and testing processes for approved products are validated and performed under current Good Manufacturing Processes (cGMP). Potency is defined as "the specific ability or capacity of the product, as indicated by appropriate laboratory tests or by adequately controlled clinical data obtained through the administration of the product in the manner intended, to effect a given result." In vivo models used during proof-of-concept and efficacy studies provide an early readout of potency by measuring a desired physiological response in animals. For product approval, in vitro assays must be developed providing a quantifiable readout that can be validated. The in vitro approach of introducing a gene into a cell line and then demonstrating its expression and functional activity has been used for over a decade in the evaluation of small molecule drug-drug interaction properties. When a small molecule drug is developed, the interaction potential of the molecule as a substrate, inhibitor, or inducer of specific drug transporters is evaluated. The U.S. Food and Drug Administration (FDA) issued the first drug transporter concept paper in 2004, and it issued draft guidance in 2006. This draft guidance was most recently updated in 2017. Although in vitro potency assays have been used in small molecule and monoclonal antibody drug development for more than a decade, applications in cell and gene therapy (CGT) product development are more recent. (Ref. 6) [Back to Newsletter's Page 1](#)

### Capturing CO<sub>2</sub> from trucks and reducing their emissions by 90%

In Europe, transport is responsible for nearly 30% of the total CO<sub>2</sub> emissions, of which 72% comes from road transportation. While the use of electric vehicles for personal transportation could help lower that number, reducing emissions from commercial transport – such as trucks or buses – is a much greater challenge. Researchers have now come up with a novel solution: capturing CO<sub>2</sub> directly in the trucks' exhaust system and liquefying it in a box on the vehicle's roof. The liquid CO<sub>2</sub> is then delivered to a service station, where it is turned into conventional fuel using renewable energy. The patented concept is the subject of a paper published in *Frontiers in Energy Research*. Scientists propose to combine several technologies to capture CO<sub>2</sub> and convert it from a gas to a liquid in a process that recovers most of energy available onboard, such as heat from the engine. In their study, the scientists used the example of a delivery truck. First, the vehicle's flue gases in the exhaust pipe are cooled down and the water is separated from the gases. CO<sub>2</sub> is isolated from the other gases



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(nitrogen and oxygen) with a temperature swing adsorption system, using metal-organic frameworks (MOFs) adsorbent, which are specially designed to absorb CO<sub>2</sub>. Once the material is saturated with CO<sub>2</sub>, it is heated so that pure CO<sub>2</sub> can be extracted from it. High speed turbo compressors use heat from the vehicle's engine to compress the extracted CO<sub>2</sub> and turn it into a liquid. That liquid is stored in a tank and can then be converted back into conventional fuel at the service stations using renewable electricity.

The whole process takes place within a capsule measuring 2 m x 0.9 m x 1.2 m, placed above the driver's cabin. "The weight of the capsule and the tank is only 7% of the vehicle's payload," "The process itself uses little energy, because all of its stages have been optimized." (Ref. 7). **[Back to Newsletter's Page 1](#)**

### The Myth of Algae Biofuels

In 2017, ExxonMobil announced an intriguing energy innovation: In partnership with biotech company Synthetic Genomics, it had used CRISPR gene-editing technology to produce a strain of algae that ExxonMobil claimed could pave the way toward a sustainable future and "reduce the risk of climate change." Ever since then, the company has used numerous social media platforms — including Facebook, Instagram, and Twitter — to share its "Miniature Science" video campaign, promoting the idea that algae could "fuel the trucks, ships and planes of tomorrow." Algae biofuels, a form of renewable energy that converts sea-growing algae into liquid fuel, have been intensely studied since the oil crisis of the 1970s. Since then, most fossil fuel companies have pursued algae biofuel research ventures, fiddling with production processes to make these sea vegetables a viable alternative energy. In recent years, however, many of these companies have abandoned their algae biofuel partnerships and projects due to the biological and economic limitations of this work. ExxonMobil remains largely alone in maintaining that a clean energy future powered by algae biofuels is just around the corner. However, this is the same company that, not too long ago, was actively discrediting legitimate climate science. Since the 1960s, ExxonMobil has known from its in-house climate scientists and climate modeling program that climate change is human-caused and driven by fossil fuel use. It subsequently conducted one of the "most sophisticated and most successful disinformation campaign[s]" ever, on par with the tobacco industry's campaign to discredit links between smoking and lung cancer. Considering this problematic history of obfuscating climate science, combined with the disappointing outcomes of algae biofuel research, ExxonMobil's efforts to promote algae biofuels as a climate solution seem disingenuous — more of a public relations strategy than a serious effort to mitigate climate change. (Ref. 8) **[Back to Newsletter's Page 1](#)**

### What will it cost to save Earth's oceans?

In 2015, 193 countries agreed on 17 global objectives for ending poverty and protecting the environment by 2030. These Sustainable Development Goals (SDGs) included SDG 14, to "conserve and sustainably use the oceans, seas and marine resources for sustainable development." A new study by two former diplomats with the CONOW Competence Centre for International Relations published in the journal Marine Policy estimates that to hit the targets needed to achieve this SDG the world must spend US\$175 billion per year. Reducing



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marine pollution will take more than half the money needed, according to the paper. At over USD\$90 billion that cost includes programs to clean up ocean trash, better manage waste and improve wastewater treatment plants. It also means investing in research on biodegradable plastics, all while working to limit plastic pollution of any kind in the first place. About one-fifth of the needed funding, the researchers say, is for protecting and restoring wetland ecosystems, coastal habitats, coral reefs and other environments. For wetlands, that could entail setting aside new areas under the Ramsar Convention, an international treaty that aims to conserve wetland wildlife and ecosystem services. For seaside ecosystems, it could mean investments in integrated coastal management. This approach brings together scientists, managers, community members and other stakeholders to cooperate on unified oversight and administration of activities in coastal areas, aiming to balance competing interests for sustainable development — all while prioritizing the preservation of biological resources and ecosystems. (Ref. 9) [Back to Newsletter's Page 1](#)

## Overall pesticide usage down, weedkiller atrazine on the rise

Vermont's overall pesticide use in 2018 was the lowest it's been this decade. But long-awaited state reports on pesticides show use of some common corn herbicides, including one banned in Europe, has not been going down. The state tracks pesticide use through annual reports from applicators and information on sales from pesticide dealers, and must, by law, make that information public. Reports on the use of pesticides in Vermont released earlier this month show use of atrazine — a weedkiller with serious health and environmental risks — has been going up slightly because of the herbicides low cost. A malfunction with a state database and limited Agency of Agriculture, Food and Markets staff delayed the release of pesticide reports for five years. Earlier this year, the agriculture agency put the pesticide reports from 2014-2018 online. The data came with the caveat that only the 2018 data has been "100% reviewed," meaning that multiple agency staff members have verified the data. Corn accounts for about three-quarters of outdoor pesticide application in Vermont, according to the agriculture agency. Pesticide use on corn and hay went up from 184,365 pounds in 2013 to 270,812 pounds in 2016. Use in that sector declined sharply in 2017 before increasing again to 232,265 pounds in 2018 — the third highest amount sprayed this decade. The reports show the most-used pesticide on Vermont farms since 2012 has been atrazine. Farmers sprayed almost 80,000 pounds of atrazine on fields in 2018, with just over half going on fields in Franklin and Addison counties. The herbicide, banned in the European Union, is widely used in the U.S. to control grassy weeds. It is classified as a "restricted use" pesticide, meaning only certified applicators can apply it. The product cannot be applied within 200 feet of lakes and reservoirs, 66 feet of streams or 50 feet of drinking water wells. (Ref. 10) [Back to Newsletter's Page 1](#)

## 5. ESD NEWSLETTER READER COMMENTS

None received this week.

Expecting the reader's comments and views on the newsletter. [Back to Newsletter's Page 1](#)



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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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