CHEMWATCH

Bulletin Board

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MAR. 27, 2020

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ASIA PACIFIC

Replacement of AICIS information sessions with educational videos

2020-03-17

Due to a growing number of cancellations, we've decided to replace our AICIS stakeholder information sessions with educational videos you can watch at your own pace. Keep an eye on our AICIS guidance hub — we'll publish the videos in the coming weeks.

NICNAS, 17 March 2020

https://www.nicnas.gov.au/news-and-events/news-and-notices

22 October 2019

How are hand sanitisers regulated in Australia?

2020-03-12

We've been receiving enquiries about hand sanitiser products, including in connection to the novel coronavirus (COVID-19). In Australia, hand sanitisers are regulated either as cosmetics or therapeutic goods depending on their ingredients and the claims made about their effects. To be regulated as a cosmetic, hand sanitisers must comply with the requirements set out in Schedule 2 of the Therapeutic Goods (Excluded Goods) Determination 2018. More information about regulatory obligations for importing or manufacturing cosmetics is available here. Further information about products making claims in relation to COVID-19 is available on the TGA website.

NICNAS, 12 March 2020

https://www.nicnas.gov.au/news-and-events/news-and-notices/news-and-notices-content/how-are-hand-sanitisers-regulated-in-australia

Keep an eye on our AICIS guidance hub — we'll publish the videos in the coming weeks.

Korea Notifies WTO Concerning Proposed Update to Food Packaging Standards

2020-03-19

The Republic of Korea recently notified the World Trade Organization (WTO) of its proposal to amend the "Standards and Specification for Food Utensils, Containers and Packages." The most recent version of the

standards and specifications was published in 2019 (see Korea's Ministry of Food and Drug Safety website).

The standards and specifications are divided in two parts. The first part has sections on: General Rules, Common Standards and Specifications, and Specifications for Individual Materials. Part II contains the Test Methods.

The specific subsections that are undergoing revision are:

1. The common manufacturing standards, the usage specifications, and the suitability determination of standard and specifications, found in the Common Standards and Specification Section
2. The standards for using of recycled synthetic resins
3. The Test Methods

A copy of the WTO notification can be found here.

Packaging Law, 19 March 2020

https://www.packaginglaw.com/news/korea-notifies-wto-concerning-proposed-update-food-packaging-standards

AMERICA

White House Greenlights Rule for Reporting Chemical Data to EPA

2020-03-16

Chemical makers will soon learn what specific information they'll have to give the EPA later this year, now that the White House has approved the agency's final data reporting rule. The White House Office of Management and Budget announced March 14 that it approved the regulation, which requires companies that make or import chemicals above specified thresholds—generally 25,000 pounds a year—to report production, use, and other information every four years. For a comparison, a 10-foot U-Haul filled with water would weigh roughly 25,000 pounds. The Environmental Protection Agency uses the information that companies report to decide what chemicals warrant its attention and to inform regulations.

OMB's approval marks the last step before EPA Administrator Andrew Wheeler signs and releases the regulation, which will say whether chemical manufacturers must submit their information electronically.

The Environmental Protection Agency uses the information that companies report to decide what chemicals warrant its attention and to inform regulations.

Susan Sharkey, from the EPA's chemicals office, recently told companies that the electronic "central data exchange" system manufacturers will use to submit their information isn't available yet, but will be before submissions are due. She spoke in early March at a chemical regulatory conference.

The EPA couldn't be immediately reached for comment on Monday. It typically publishes rules soon after OMB's approval.

Reporting is scheduled to last from June 1 to Sept. 30. But the EPA often publishes revisions to the Chemical Data Reporting rule only a few months before reports are due, therefore delaying the start of reporting.

Bloomberg Environment, 16 March 2020

https://news.bloombergenvironment.com/environment-and-energy/white-house-greenlights-rule-for-reporting-chemical-data-to-epa

Military sees surge in sites with 'forever chemical' contamination

2020-03-16

The military now has at least 651 sites that have been contaminated with cancer-linked "forever chemicals," a more than 50 percent jump from its last tally. The information was released Friday in a report from the Department of Defense (DOD), part of a task force designed to help the military remove a class of chemicals known as PFAS from the water supply near numerous military bases. PFAS, used in a variety of household products as well as an "AFFF" fire fighting foam relied on by the military, has been deemed a forever chemical due to its persistence in both the environment and the human body. The military has been under increasing pressure to clean up its contaminated sites, previously estimated to be at 401 locations.

The military has been under increasing pressure to clean up its contaminated sites, previously estimated to be at 401 locations.

"This report also makes it clear that we are still learning the full extent of the impact on our communities. The identification of over 250 new sites where PFAS was potentially released is astonishing," House Armed Services Committee Chairman Adam Smith (D-Wash.) said in a statement.

"It is critical that the department provide communities with timely assessment of these sites, communicate transparently with impacted households, and quickly act to protect civilians and service members alike from these forever chemicals."

Defense Secretary Mark Esper started the PFAS task force on his first day in office in July.

"We must approach the problem in an aggressive and holistic way, ensuring a coordinated DOD-wide approach to the issue," Esper wrote in a memo establishing the task force.

The 651 figure is current as of October and includes only sites where DOD is known to be the source of PFAS contamination.

The military has provided bottled water and filters to the affected areas and is prepared to ramp up blood testing for those that may be affected.

"No one — on or off base — is drinking water above EPA's [health advisory] level of 70 parts per trillion [ppt] where DoD is the known source of PFOS and PFOA," the agency wrote in the report, referring to guidelines set by the Environmental Protection Agency.

However, those voluntary EPA standards are in the process of being replaced with a mandatory drinking water regulation —something that may fall below the 70 ppt currently being used by DOD.

Many critics have argued that the 70 ppt figure is too high to protect health and have advocated for setting the standard at a lower number, following the move of many states who have more aggressive PFAS regulations than the federal government.

The Hill, 16 March 2020

https://thehill.com/policy/energy-environment/487782-military-sees-surge-in-sites-with-forever-chemical-contamination

3M Announces Progress on PFAS Initiatives and Actions

2020-03-19

3M announced its latest actions as part of the company's ongoing efforts to research and share information related to per-and polyfluoroalkyl substances (PFAS). These actions advance the five initiatives and actions 3M announced in September 2019, building on the company's longstanding commitment to environmental stewardship. Most prominently, 3M has launched a research clearinghouse webpage and is releasing previously unavailable PFAS reference standards. These mark an important step in advancing the collective scientific knowledge around PFAS.

These actions advance the five initiatives and actions 3M announced in September 2019, building on the company's longstanding commitment to environmental stewardship.

The clearinghouse compiles published research 3M has conducted around PFAS testing, measurement and remediation best practices to facilitate access to information for communities and officials around the country. In addition, industry-leading PFAS reference standards will be made available for free to government officials, researchers and academic institutions. There are many different types of PFAS, and many reference standards for these compounds are not commercially available. 3M's samples will make it easier to reliably study and test for PFAS materials—decreasing costs and expediting timelines for researchers.

"I am proud of the work we have done to engage with stakeholders and positively contribute toward the science of PFAS," said Denise Rutherford, senior vice president, 3M Corporate Affairs. "We believe that current and future progress resulting from these actions can help facilitate a more inclusive, science-based discussion around PFAS and the critical role they play in so many modern applications."

3M has also made progress on its other previously announced initiatives, including a commitment to ongoing remediation, coordinating research into PFAS, supporting nationwide science-based regulation, and ensuring appropriate disposal of Aqueous Film Forming Foam (AFFF).

The company is in the process of setting up an AFFF Stewardship pilot program that will support the proper disposal of the company's legacy AFFF product that its customers may still store. 3M also implemented its latest granular activated carbon (GAC) treatment system in Decatur, Alabama. Finally, 3M remains engaged in an effort to identify an established and independent scientific body to review the existing science on PFAS and develop an agenda for further research. While that effort is ongoing, 3M continues to collaborate with leading universities and government agencies like National Fermilab, California Institute of Technology and the University of Minnesota to advance the science of PFAS.

"The progress we've made on fulfilling our commitments is a positive step, and we will continue to identify new ways to share best practices and information about PFAS," said Rutherford.

For more information about 3M's ongoing efforts related to PFAS, visit www.3M.com/PFAS

3M, 19 March 2020

https://news.3m.com/press-release/company-english/3m-announces-progress-pfas-initiatives-and-actions

COVID-19: OSHA issues employer guidance

2020-03-17

While there are no specific Occupational Health and Safety Administration (OSHA) standards covering COVID-19 (coronavirus), OSHA has published guidance intended to help employers protect their workers from exposure and prevent COVID-19 from spreading.

Under the General Duty Clause, employers are required to furnish workers with a place of employment that is free from recognized hazards that are causing, or are likely to cause, death or serious physical harm. OSHA and the Centers for Disease Control and Prevention (CDC) recommend the following initiatives to best safeguard your work environment from COVID-19.

Under the General Duty Clause, employers are required to furnish workers with a place of employment that is free from recognized hazards that are causing, or are likely to cause, death or serious physical harm.

Engineering controls: Isolate employees from the hazard using high-efficiency air filters or increasing ventilation rates.

Administrative controls: Change workplace procedures to reduce or minimize a hazard by encouraging sick employees to stay home and developing emergency communication plans (i.e., social distancing).

Safe work practices: Reduce the duration, frequency or intensity of exposure to the hazard by providing tissues and no-touch trash cans and require regular hand washing or use of alcohol-based hand rubs.

Personal protective equipment (PPE): Minimize exposure by requiring correct use of PPE, such as respiratory protection, goggles or gloves. The appropriate type of PPE should be selected based on the hazard to the employee, regularly inspected and properly cleaned.

Travel guidelines: Restrict unnecessary travel and require precautions for those who must travel.

For more examples on how to protect your employees and what your company can do to prepare the workplace for COVID-19, visit Bricker & Eckler's COVID-19 Resource Center and COVID-19 webpage.

Bricker & Eckler, 17 March 2020

https://www.bricker.com/insights-resources/publications/covid-19-osha-issues-employer-guidance

EUROPE

Exceptional approval for hand disinfectants

2020-03-17

As a result of the spread of the SARS-CoV-2 coronavirus, disinfectants for hand disinfection are increasingly in demand in Germany. Appropriate preparations are practically no longer available in pharmacies and drugstores.

For this reason, the Federal Agency for Chemicals, as the competent authority after consultation with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, gives the general decree for the approval of 2-propanol-containing biocidal products for hygienic hand disinfection in accordance with Article 55 paragraph 1 of Regulation (EU) No. 528 /2012.

Appropriate preparations are practically no longer available in pharmacies and drugstores.

BAuA, Federal Institute for Occupational Safety and Health, March 2020

https://www.baua.de/DE/Angebote/Aktuelles/Meldungen/2020/2020-03-04-Desinfektionsmittel.html

Germany TRGS 905 List of carcinogenic, mutagenic or reprotoxic substances updated

2020-03-13

On 13 March 2020, the German Committee on Hazardous Substances (Ausschuss für Gefahrstoffe - AGS) Technical Rules for Hazardous Substances (TRGS) 905 List of carcinogenic, mutagenic or reprotoxic substances was updated. The following substance was added: Oxidation

bitumen: steam and aerosol during the hot processing of oxidation bitumen

Yordas Group, 19 March 2020

https://www.yordasgroup.com/hive/news/article/860

Germany TRGS 900 Workplace exposure limits updated

2020-03-13

2-Chlorethanol, Chloroethylene, Ethanethiol, Methanethiol, Methanol, Methyl formate and Polyethylene glycols (PEG 200-600).

On 13 March 2020, the German Committee on Hazardous Substances (Ausschuss für Gefahrstoffe - AGS) Technical Rules for Hazardous Substances (TRGS) 900 Workplace exposure limits were updated.

The following substance were added:

Bitumen: steam and aerosol for the hot processing of distillation and air-rectified bitumen

Dichloroacetic acid and its salts

The following substance was deleted:

Zirconium and water insoluble compounds

The limits of the following substances were updated:

The limits of the following substances were updated:

2-Chlorethanol

Chloroethylene

Ethanethiol

Methanethiol

Methanol

Methyl formate

Polyethylene glycols (PEG 200-600)

Yordas Group, 13 March 2020

https://www.yordasgroup.com/hive/news/article/858

Community rolling action plan update covering the years 2020, 2021 and 2022

2020-03-18

The Community rolling action plan (CoRAP) update for the years 2020 – 2022 lists 74 substances for evaluation by the Member State competent authorities under the substance evaluation process of the REACH Regulation (EC) No 1907/2006 (Articles 44 to 48). The plan contains seven newly allocated substances and 67 substances as already published in the previous CoRAP on 19 March 2019. The substances are distributed for evaluation in years 2020, 2021 and 2022 between 17 Member States. In 2020, 14 substances are to be evaluated by seven Member States. In 2021 and 2022, it is planned to evaluate 32 and 28 substances, respectively. However, in March 2021 this plan is going to be updated again and changes may be introduced for the substances listed for years 2021 and 2022 (Article 44(2) of the REACH Regulation). Also substances may be added or withdrawn for those years. The CoRAP update has been prepared in close cooperation with the Member States, taking into account the criteria for selection of substances1 . A draft CoRAP was submitted on 10 October 2019 to the Member States and to the Member State Committee (MSC) for its opinion. The draft CoRAP was published on the ECHA website on 10 October 2019. ECHA adopted the updated CoRAP on the basis of the opinion of the MSC taken on 10 December 2019 and published it on 18 March 2020 on its website. Comparing to the previous CoRAP update for years 2019 – 2021, 52 changes were made in the year of evaluation in the CoRAP update 2020-2022 postponing the evaluation year. The main reason was awaiting results from ongoing dossier evaluation processes on the same substance. A secondary reason was aligning the timing for similar substances in order to achieve higher consistency between assessments including awaiting results for similar substances, as well as limited resources of the evaluating Member State. Two of the existing entries have been withdrawn upon requests of the evaluating Member State having revised the respective cases. The underlying reasons are that in one case the only registrant ceased manufacture of the substance rendering an evaluation obsolete. In the second case the designated Member State revised the initial ground of concern and considered that the evaluation of the substance was currently not needed. The withdrawn substances are:

Isopropyl naphthalene (249-535-3) and

3-methyl-1,5-pentanediyl diacrylate (264-727-7).

The plan contains seven newly allocated substances and 67 substances as already published in the previous CoRAP on 19 March 2019.

Further information

A description of the substance evaluation process and CoRAP is available on ECHA's website . In the CoRAP update the grounds for the initial concern that triggered the selection of substances for evaluation are briefly described. The concerns per substance are explained in more detail in the related justification documents available in the dynamic CoRAP table published on ECHA website3 . In the CoRAP the contact information of the Member State competent authority is provided for each substance to facilitate interaction of registrants with evaluating authorities. ECHA encourages such interaction in order to clarify any concerns related to the substances in question4 . While this applies to all substances on the CoRAP, it is particularly relevant for substances to be evaluated in 2020.

ECHA, 18 March 2020

https://echa.europa.eu/documents/10162/13628/corap_update_2020-2022_en.pdf/203bad07-23cc-2000-54ba-5f96dcd0e3a8

ECHA's committees conclude on five restrictions

2020-03-16

Corrigenda 18 March 2020: RAC's and SEAC's opinions on formaldehyde clarified. 19 March 2020: Nr of agreed draft opinions of RAC on applications for authorisation clarified.

The Committee for Socio-economic Analysis (SEAC) adopted its opinion on the restriction proposal for siloxanes (D4, D5, D6) in personal care products while the Committee for Risk Assessment (RAC) adopted its opinion, among others, on skin sensitising substances used in textile and leather products.

Helsinki, 16 March 2020 – SEAC adopted its final opinion supporting ECHA's proposal to restrict the placing on the market of D4, D5 and D6 as substances, as contituents of other substances, or in mixtures in a concentration equal to or greater than 0.1 % weight by weight of each substance. This proposal covers both leave-on personal care products (D4, D5 and D6) and other consumer or professional products as well as wash-off personal care products (D6). SEAC also agreed on its draft opinion on ECHA's proposal to restrict the placing on the market, manufacture and use of five cobalt salts as substances on their own or in mixtures in a concentration equal or above 0.01 % by weight in industrial and professional applications. RAC adopted its opinion on this restriction proposal by written procedure in February 2020. RAC adopted its opinion

This proposal covers both leave-on personal care products (D4, D5 and D6) and other consumer or professional products as well as wash-off personal care products (D6).

on France and Sweden's proposal to restrict skin sensitising substances in finished textile, leather, hide and fur articles, placed on the market for the first time. Agreement on the SEAC draft opinion is postponed until June 2020. RAC and SEAC supported Norway's proposal to restrict the manufacture or placing on the market of PFHxS (linear or branched), its salts or related substances and as a constituent of another substance, in a mixture or in articles. Furthermore, SEAC supported ECHA's proposal to restrict the placing on the market of articles releasing formaldehyde at concentrations greater than 0.124 mg/m3 and that a formaldehyde concentration of 0.1 mg/m3 shall not be exceeded in the interiors of road vehicles and aircraft. RAC's opinion supported the proposal but included several proposed modifications to its scope and conditions. Consultations on the agreed SEAC opinions (cobalt salts, PFHxS and formaldehyde) will begin soon and the committee is expected to adopt its opinions at its June 2020 meeting. The committees did not reach agreement on ECHA's proposed restriction of intentionally-added microplastics and will continue discussions in June.

Applications for authorisation

RAC and SEAC adopted two opinions on applications for authorisation on one use of chromium trioxide and one use of octylphenol ethoxylates. In addition, RAC agreed on 16 draft opinions on applications for authorisation of uses of octyl- and nonylphenol ethoxylates; pitch, coal tar, high temperature; anthracene oil and chromium trioxide, reaching provisional agreement on 21 further uses, which will now go to written procedure.

SEAC agreed on 27 draft opinions on uses of octyl- and nonylphenol ethoxylates and pitch, coal tar, high temperature. Furthermore, RAC discussed key issues in 10 applications for authorisation, which were received by ECHA in November 2019. More information about the opinions is available in the annex.

ECHA, 16 March 2020

https://echa.europa.eu/-/echa-s-committees-conclude-on-five-restrictions

Make sure your chemical safety report is complete – we'll start to check in April 2020

2020-02-13

Once you have submitted your registration dossier, ECHA checks that all the necessary information is included. In April 2020, we will expand our

In April 2020, we will expand our checks to cover, among other things, chemical safety reports. Is yours complete?

checks to cover, among other things, chemical safety reports. Is yours complete?

From April 2020, we will check that use and exposure information as well as risk characterisation is included in your chemical safety report (CSR). This information has to be there because it forms the basis for risk management measures that companies communicate through their supply chains and need to follow to protect their workers and the environment. The checks of the chemical safety report will be based on the uses you have reported in your registration dossier. We will be checking the completeness of chemical safety reports for any registrations where the substance tonnage band is more than 10 tonnes per year and the substance is classified as hazardous to the environment or human health, or has persistent, bioaccumulative and toxic properties. Your registration dossier will not be checked for the CSR if you are part of a joint submission and you rely on the chemical safety report submitted in the lead registrant dossier.

The new checks on the chemical safety report will only verify that the required elements are present and will not look at the adequacy of the information submitted. The checks will be carried out for both initial dossiers and their updates. If the chemical safety report cannot be opened or is written in a language other than one of the official EU languages, it will be considered incomplete and your submission will fail.

Why the change is needed

We previously improved the completeness check rules in 2016 when some automated, computer-based checks were revised and some manual checks were added. Based on this experience, we expect that additional manual checks on chemical safety reports will further improve the data availability in REACH registrations. For authorities this means that they will have a better basis for prioritising substances that need further regulatory action, whereas companies will be in a better position to communicate appropriate information to their customers. Information on uses is also published on ECHA's website if they have not been claimed confidential.

The new rules do not mean that any of the legal requirements in REACH would change, we simply improve the way ECHA checks that the requirements have been met.

Use Chesar to prepare your chemical safety report

REACH Update

Since chemical safety reports are text documents attached to IUCLID dossiers, a computer-based verification of that information is not possible. A group of ECHA staff will carry out the checks manually following standard instructions to guarantee that each check is performed using the same principles. As the checks are manual, the Validation assistant available in IUCLID will not be able to report on completeness issues found in your chemical safety report.

When preparing your CSR, we recommend using the Chemical Safety Assessment and Reporting tool, Chesar. Chesar contains a workflow that guides you in filling in the necessary information consistently. It helps you address all reported uses, routes of exposure and environmental compartments, in line with the outcome of the hazard assessment. Once you have finalised your chemical safety assessment, you can automatically create a chemical safety report that you can attach to your IUCLID dossier. As Chesar exchanges data with IUCLID, the information recorded in your IUCLID dossier will be consistent with that in your chemical safety report.

Although ECHA recommends you to use Chesar, it is not mandatory. Any chemical safety report format is accepted as long as you have included all information listed in REACH and the reader can clearly identify all the main elements.

Other improvements

There will be some changes to the computer-based completeness checks, too. To make sure that the standard information requirements described in REACH Articles VII-X are met, we are improving the way the elements for key hazard endpoints are checked. More explicit checks will be carried out for the following endpoints: mutagenicity, reproductive toxicity and degradation.

Information related to the substance life cycle will also be checked as part of the computer-based verification. This means that the checks will detect if, based on the use description, the registration should also include information about article service life.

Since these changes will become part of the computerised checks, they will also be included in the updated IUCLID Validation assistant which is recommended to be used before submitting the data to ECHA.

New rules apply from end of April 2020

The improved completeness check will start to apply at the end of April following the release of a new version of IUCLID.

REACH Update

MAR. 27, 2020

It is good to keep in mind that the new rules apply both to new registrations and registration updates. This means that your update may not pass the completeness check anymore, even though your previous registration did. However, if your update would be considered as incomplete, it does not directly impact your current registration. It means that the information you intended to submit to ECHA needs to be amended and resubmitted before it applies to your registration and can be taken into account by authorities.

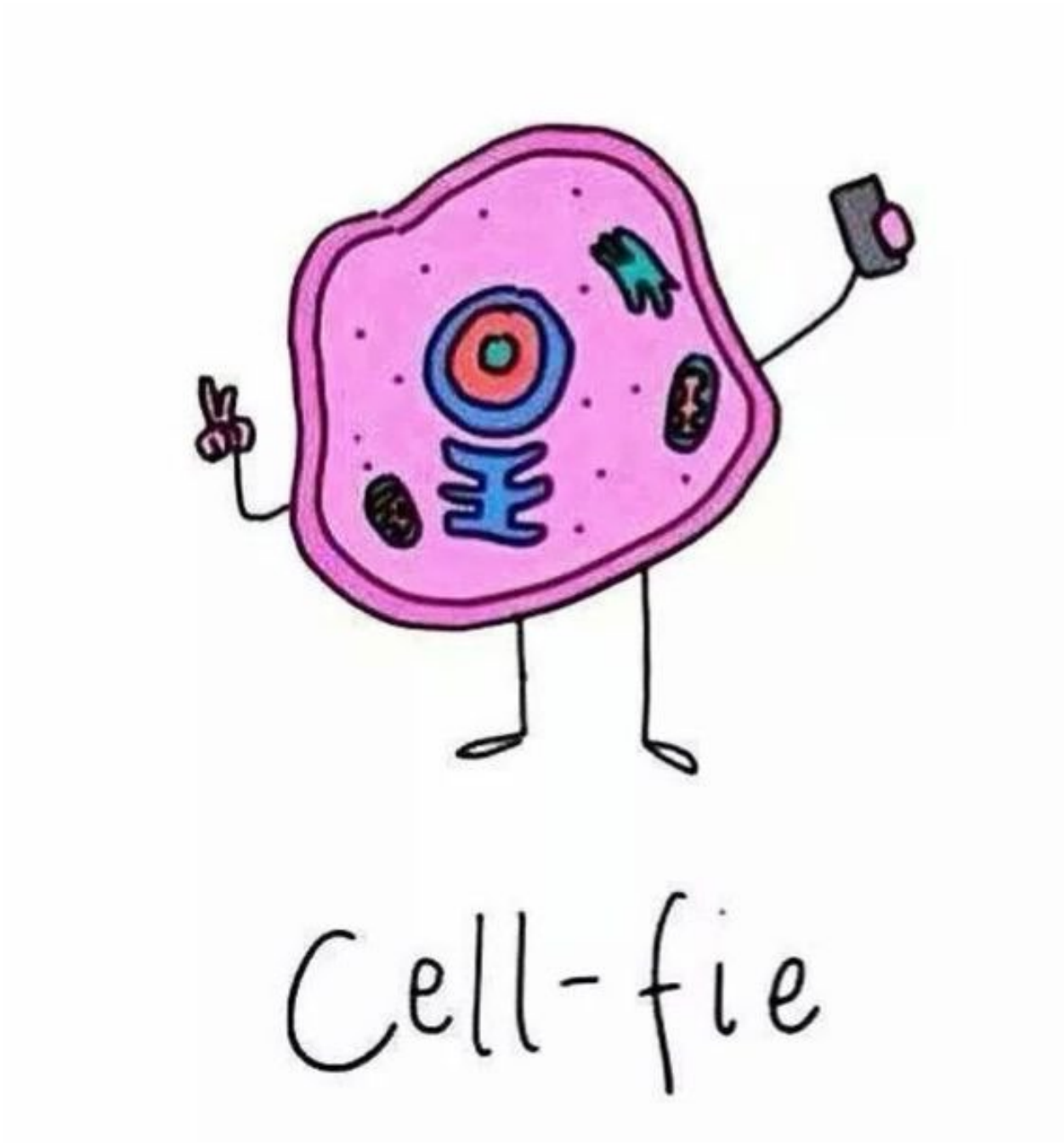
To ensure that you have included all required information in your registration dossier, start by checking it with the Validation assistant before submitting anything to ECHA. The tool is being updated and the latest version will be included in the April release of IUCLID. In addition, an updated version of the document supporting users in the areas of manual verification is expected to be available on the ECHA website by the end of February. If you are not yet doing so, consider using Chesar for your chemical safety assessment and report as this will decrease the chance of incompleteness. We recommend companies to also have a look at our recent webinar and related Q&As on the revised completeness check to get further help. If you have case-specific questions, a team of ECHA experts can be reached through a contact form on our website.

ECHA Newsletter, February 2020

https://newsletter.echa.europa.eu/home/-/newsletter/entry/make-sure-your-chemical-safety-report-is-complete-we-ll-start-to-check-in-april

Cell-fie

2020-03-10



https://www.pinterest.com.au/pin/201254677085914953/

Formaldehyde

2020-03-17

Formaldehyde is a chemical compound made up of hydrogen, oxygen and carbon. It is naturally produced by all life forms as part of cell metabolism and it is written formulaically as: H-CHO. Formaldehyde is the simplest form of an aldehyde. The compound comes in various forms, including a colourless, pungent gas and a linear polymer called paraformaldehyde. A third form is the cyclic trimer metaformaldehyde. In 2011, the US National Toxicology Program categorised formaldehyde as a human carcinogen. [1,2]

USES [1,2]

Formaldehyde is used in many different applications, including construction, healthcare and automobiles. Little, if any, formaldehyde is left in consumer-ready products. In building, the compound is often used in the form of formaldehyde-based resins, which are used in flooring, support beams, shelving, mouldings and furniture. When used as a building block in glue, formaldehyde makes an exceptionally strong bonding agent. In healthcare, the compound is used in vaccines, hard-gel capsules and anti-infective drugs. Formaldehyde is also used in personal care products as a preservative to kill bacteria and extend shelf-life. Finally, in automobiles, formaldehyde-based resins are used for their high temperature and physical durability.

Formaldehyde is a chemical compound made up of hydrogen, oxygen and carbon.

ROUTES OF EXPOSURE [1, 3]

- Formaldehyde does not accumulate in animals or people, as it is quickly broken down by the body's natural processes.
- People can be exposed to formaldehyde by skin contact, inhalation, or by eye contact.
- Formaldehyde is naturally found in every living organism, and is produced by humans to build basic internal materials.
- It can be found in a range of meats, fish, coffee, alcoholic beverages and fruits.

HEALTH EFFECTS

Formaldehyde poisoning can affect a range of systems and areas of the body, including the skin, and the nervous, respiratory and cardiovascular systems.

Acute Effects [3]

Severity of symptoms depends on the level and type of exposure.

- If formaldehyde is inhaled, the victim may experience a runny nose, coughing and irritation of the respiratory tract and nasal mucous membranes.
- If formaldehyde is inhaled in large quantities, there may be respiratory difficulties, including possible laryngeal spasm, a possible oedema of the upper respiratory tract and the risk of a lung oedema.
- If swallowed in small amounts, formaldehyde can cause nausea, diarrhoea and vomiting.
- If formaldehyde is swallowed in high quantities, symptoms may include CNS depression, blood in vomit and/or stool, dizziness, urine discolouration or change in composition and shock.
- Eye contact by formaldehyde will corrode the eye tissue.
- If there is skin contact, formaldehyde will cause caustic burns.

Chronic Effects [3]

Formaldehyde is toxic to multiple body systems. Long-term exposure to the compound can cause skin changes, including red and dry skin and rash or inflammation. It can also result in coughing and inflammation of the respiratory tract as well as other respiratory difficulties.

SAFETY

First Aid Measures [3]

- Ingestion: If ingested, rinse mouth and DO NOT induce vomiting. Immediately call a doctor or a poison centre.
- Ingestion in large amounts: if ingested in large quantities, take victim immediately to hospital, along with the container of vomit.
- Skin contact: In case of skin or hair contact, shower/wash immediately for at least 15 minutes with water. Remove all contaminated clothing immediately while washing. If clothes stick, do not remove. Wrap wounds with a sterile bandage. Consult doctor. If >10% of skin is covered in burns, take victim to hospital.
- Eye contact: Flush eyes carefully with water for 15 minutes. DO not apply a neutralizing agent. Take person to an ophthalmologist.
- Inhaled: Take contaminated person to nearest fresh air source and monitor their breathing. Immediately contact a doctor.

Exposure Controls/Personal Protection [3]

- Engineering controls: Safety showers and emergency eyewash fountains should be accessible in the immediate area of the potential exposure. Ensure there is adequate ventilation. Whenever possible, material should be handled in a laboratory.
- Personal protection: Safety glasses, protective and dustproof clothing, a face shield and a gas mask with a filter type A.

REGULATION [5]

United States:

The Occupational Safety and Health Administration (OSHA) has set an 8-hour time-weighted average (TWA) concentration for formaldehyde of 0.75 parts per million (ppm). For their Short Term Exposure Limit (15 minutes), OSHA has set a limit of 2ppm.

Australia [4]

Safe Work Australia: Safe Work Australia has set an 8-hour TWA concentration for formaldehyde of 1ppm.

REFERENCES

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2. https://en.wikipedia.org/wiki/Formaldehyde
3. http://www.labchem.com/tools/msds/msds/VT310.pdf
4. https://www.safeworkaustralia.gov.au/system/files/documents/1702/research-report-awes-formaldehyde.pdf
5. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10075&p_table=STANDARDS

When Beauty Products Were Radioactive

2020-03-09

A miracle cream was launched in Paris in 1933. Billed as a "scientific beauty product," it promised to improve circulation, firm muscle tissue, reduce fat and smooth wrinkles. It was part of a line of cosmetics called Tho-Radia -- after thorium and radium, the radioactive elements it contained. Today, no one would intentionally smear radioactive materials on their face, but in 1933, the dangers of radioactivity were not yet fully understood. This mysterious new form of energy, discovered by French physicist Henri Becquerel in 1896, had become imbued with mythical powers. "Before people started to fear radioactivity, all they seemed to know about it was that it contained energy," said Timothy J. Jorgensen, an associate professor of radiation medicine at Georgetown University, in a phone interview. "There were implications that the energy would help your teeth if they put it in toothpaste and give you a glowing expression if they put it in facial cream. But there really wasn't any science to show that it was true." Soon after its discovery, radioactive beauty products were hitting the shelves. The creams didn't work as advertised but that didn't stop Tho-Radia cosmetics from becoming popular. It's full range of products all purported to unleash the benefits of radioactivity, including lipstick and facial powder, as well as ointments, soap, suppositories, razor blades, energy drinks and even condoms.

Today, no one would intentionally smear radioactive materials on their face, but in 1933, the dangers of radioactivity were not yet fully understood.

Like gold

When the first radioactive consumer products were launched, in the early 1900s, radioactivity was a brand new field of science. Becquerel was credited with its discovery, but the term "radioactivity" itself was coined by Polish-French scientist Marie Curie in 1898, the same year she discovered radium. Medical practitioners found early successes using radium and X-ray imaging, and consumer brands tried to capitalize from radiation therapy's reputation. "X-rays, another form of radiation, and radium were being used in medicine to treat a variety of diseases," said Paul Frame, a health physicist at the Oak Ridge Associated Universities, in a phone interview. "Radioactivity, when used properly by someone who knew what they were doing, could cure cancer. We still use radioactive sources today, although not radium, to deal with cancer." Radium was so popular in the consumer market that many products claimed to be radioactive, even if they weren't. "It was like saying 'I have a gold credit card.' It's not actual gold, it's just that gold conveys an idea of value, something important. And radium was like that back in the day," said Frame. But radiation has an indiscriminate, destructive effect on the human body, and must be

targeted at cancerous cells. The idea that putting radioactive elements in everyday products would have beneficial results turned out to be a catastrophically incorrect assumption. How dangerous was it to use radioactive creams? Luckily, they didn't cause much harm. "These creams didn't do any good, but they had such low levels of radioactivity that I can't imagine any kind of an effect. At the end of the day it was a gimmick," said Frame.

But other kinds of products meant to be ingested proved lethal. A popular one was Radithor, an "energy drink" consisting of distilled water with tiny amounts of radium dissolved into it. Boldly advertised as "A Cure for the Living Dead," it promised to tackle various ailments from diabetes to sexual decline. Far from being a panacea, it killed its most famous advocate, American socialite and athlete Eben Byers, who became notorious for drinking up to three bottles of Radithor every day for years. He died from it in 1932, and the Wall Street Journal ran the headline: "The radium water worked fine until his jaw came off." It is unclear if other deaths were linked to Radithor, but that may be due to its prohibitive price -- Jorgensen notes that it was simply too expensive for most people to purchase on a regular basis.

Radium girls

Byers was not the first victim of novelty radiation. In the mid-1920s, radium watches became a style marker -- Jorgensen calls them "the iPhones of the age." Wearing the watches didn't carry much risk, but the factory workers who made them glow suffered terrible health effects. Applying radioactive paint to the watch dials was a delicate but painstaking task that was considered women's work. These "radium girls," as the workers came to be known, were instructed to keep the brushes pointed using their lips. Over time, they started to suffer from a condition called "radium jaw," as repeatedly ingesting small amounts of radium caused necrosis of their bones. However, the radiation sickness, and in some instances death due to exposure suffered by these workers, didn't hurt the popularity of radioactive products as much as Byers's passing did, given his status in the public eye. The final blow came in 1938, when the Federal Food, Drug and Cosmetic Act outlawed deceptive packaging, making it harder for most radioactive products to promote their outlandish claims. By that time, the general appetite for such remedies had already begun to subside. The few brands that survived -- including Tho-Radia's miracle cream -- did away

with the active ingredients entirely, making the products radioactive in name alone.

edition.cnn.com, 9 March 2020

https://www.edition.cnn.com

The planet's largest ecosystems could collapse faster than we thought

2020-03-11

If put under the kind of environmental stress increasingly seen on our planet, large ecosystems —such as the Amazon rainforest or the Caribbean coral reefs—could collapse in just a few decades, according to a study released today in *Nature Communications*. In the case of Amazon forests, stressors could cause collapse in just 49 years. In Caribbean coral reefs, it could take as little as 15 years. "The messages here are stark," said lead researcher John Dearing, a professor in physical geography at the University of Southampton, in a statement. Those estimates come from Dearing and colleagues who examined data on how 42 natural environments—small and large, and on both land and water—have transformed. They found that larger ecosystems may take longer than small ones to collapse, but the rate of their decline is much more rapid. Ecosystem stress can come in many forms such as climate change, deforestation, overfishing, pollution and ocean acidification. "Humanity now needs to prepare for changes in ecosystems that are faster than we previously envisaged through our traditional linear view of the world, including across Earth 's largest and most iconic ecosystems, and the social–ecological systems that they support," the authors wrote. Larger ecosystems are made up of smaller "sub-systems" of species and habitats, which provide some resilience against rapid change. However, once these smaller systems start to collapse, the new study finds the large ecosystems as a whole fall apart much faster than previously expected. Researchers pointed to the destructive Australian and Amazon rainforest wildfires as recent examples of this dangerous fast rate of collapse. "These findings are yet another call for halting the current damage being imposed on our natural environments that pushes ecosystems to their limits," Dearing added.

In the case of Amazon forests, stressors could cause collapse in just 49 years.

ehn.org, 11 Mach 2020

https://www.ehn.org

Record-high global tree cover loss driven by agriculture

2020-03-10

Across the globe, tree cover loss hit record highs from 2016-2018, with roughly the size of a soccer field lost each second. In 2018 alone, the area of tree cover loss was larger than the UK. Using high-resolution Google Earth imagery, researchers measured global forest loss from 2001-2015 and categorized its causes. These results, published in *Science* in 2018, were recently updated by the World Resources Institute (WRI) and The Sustainability Consortium on the Global Forest Watch website to include information for 2016 through 2018. The new data reveals global tree cover loss reached an all-time high in 2016 and 2017, with the drivers of loss relatively unchanged from previous years. Worldwide, the primary culprit continued to be agriculture. "The updated data show that for most of the world, the dominant drivers of tree cover loss have remained relatively unchanged since our original 2001-2015 analysis," said Nancy Harris, an author of the original study and Research Director of the Forest Program at WRI to Mongabay. "To me, this signifies we've made very little headway addressing the major culprits, like commodity production, that are driving loss at such a massive scale." Forestry and wildfires drove tree cover loss in the northern hemisphere. Wildfires, including the massive fires in California, were associated with over 5.2 million hectares of tree cover loss between 2016 and 2018 in North America. "While the model still can't distinguish between true wildfires and those set as prescribed burns," Harris said, "the ever-growing classification of wildfire as a driver of tree cover loss signals that the effects of climate change are changing fire regimes around the world." In the tropics, almost half of total loss was driven by agricultural activities such as deforestation for oil palm plantations, cattle grazing, and other commercial commodities, as well as the expansion of small-scale farming. "We want these results to keep the attention on regions undergoing recent deforestation and see action to stop the continued conversion of forests to agriculture," said Christy Melhart Slay, director of technical alignment for The Sustainability Consortium. Columbia saw a dramatic deforestation spike in 2018, with massive areas cleared for livestock ranching to produce beef. Expanding small-scale agriculture and commodity-driven deforestation pushed into primary forests, with over 200,000 hectares (almost 500,000 acres) lost in 2018. Nearly three-quarters of this was primary forest. "The last three years of data helped to confirm recent reports about what's happening to the new forest frontiers that are now open for development following the end of the FARC occupation," said Harris. "The 2016-2018 drivers analysis shows us that the loss is indeed being driven by deforestation for commodity

In 2018 alone, the area of tree cover loss was larger than the UK.

production, including illegal land grabbing for pastureland to raise cattle." Thailand also saw increased forest loss driven by intensification of agriculture in the northern regions. For instance, around Chiang Mai, more traditional methods of subsistence farming with diverse crops are being replaced by larger-scale commodity production such as growing corn for cattle feed. "In the coming years we will be watching closing to see if this trend plays out in other locations, like Western Africa," Harris said. Though some of the fine-scale trends are not captured by this data and some known drivers of tree cover loss (such as natural disasters) are not accounted for, this type of research provides a broad look at deforestation and its causes across the globe. "With this data, it's time to take a hard look at the drivers behind the drivers," Slay said. "Which companies are operating in new deforestation fronts, what are the economic incentives behind continued deforestation, what are the barriers to enforcing deforestation policies?" "Essentially, we need to ask ourselves, are the billions of dollars being spent on zero deforestation efforts going to the right places at the right time to prevent new fronts from opening up?" Demand for several key commodities—palm oil, soybeans, leather, beef, timber, and pulp and paper — drives deforestation worldwide. A slew of major companies committed to ending deforestation connected to these commodity supply chains by 2020 after the Consumer Goods Forum in 2010 and in the New York Declaration on Forests in 2014. However, most of these companies are set to miss their own deadlines. The Sustainability Consortium, according to Slay, plans to track the sustainability performance of products to incorporate "more rigorous methods of identifying leadership and calling out corporate laggards across all environmental and social issues including deforestation."

news.mongabay.com, 10 March 2020

https://www.news.mongabay.com

EU to introduce waste reduction targets, new sustainable products law

2020-03-11

BRUSSELS (Reuters) - The European Commission said on Wednesday it will introduce new waste reduction targets and sustainability laws to ensure that products placed on the EU market are recyclable, repairable and designed to last longer, its latest plan to halve waste by 2030. "The goal in the end is decoupling resource extraction from our economic growth," the EU's environment commissioner Virginijus Sinkevicius told reporters in Brussels. Under the new plan, the Commission will present new legislation

Under the new plan, the Commission will present new legislation to ban the destruction of unsold durable goods, and restrict products' single-use and premature obsolescence, particularly targeting electronic devices.

to ban the destruction of unsold durable goods, and restrict products' single-use and premature obsolescence, particularly targeting electronic devices. The sector has "a massive impact" and "is constantly growing," Sinkevicius said, adding the EU is looking at introducing a common mobile phone charger and encouraging consumers to seek repairs. Additionally, the bloc's executive would target textiles. Only 1% of global textiles are currently recycled. "Textile is the new plastics," Sinkevicius said. Intentionally added microplastics would be restricted and measures would make recycled content and waste reduction mandatory. The Commission will also propose a new regulatory framework for batteries and overpackaging, progressively phasing-out non-rechargeable batteries and limiting packaging waste. The plan would still need approval from EU member states and the European Parliament.

reuters.com, 11 March 2020

https://www.reuters.com

Study Finds Staggering Economic Benefit From Protecting Wetlands

2020-03-12

Over long periods, coastal wetlands like these build up sediment that mitigates sea level rise and local land subsidence.

Mangrove forests, marshes, and seagrass beds protect inland areas from storm surges and strong winds. Over long periods, coastal wetlands like these build up sediment that mitigates sea level rise and local land subsidence. A new analysis of property damage from Atlantic and Gulf of Mexico coastal storms has shown that counties with larger wetlands suffered lower property damage costs than did counties with smaller wetlands. "Starting in 1996, the U.S. government started to produce damage estimates for each tropical cyclone in a consistent manner," explained coauthor Richard Carson, an economist at the University of California, San Diego (UCSD) in La Jolla. Before that, the data were collected only for hurricanes, which hindered past attempts to put a price on the marginal value, or price per unit, of wetlands, he said. With the complete data set, the researchers examined all 88 tropical cyclones and hurricanes that affected the United States starting in 1996. That time period includes Hurricanes Katrina and Sandy.

A Protective and Economic Boon

In addition to property damage data for tropical cyclones of all strengths, "our data set has considerably more spatial resolution," Carson said, "which is a result of large amounts of information on storm tracks, property

location, and wetland location all being digitized for use in a geographical information system basis." First author Fanglin Sun, formerly at UCSD and now an economist at Amazon.com, added that "areas subject to flood risk in a county are more accurately estimated, based on local elevation data and detailed information on individual storm trajectories" and wind speeds throughout affected areas. The finer level of detail for the storm data let the researchers finally begin connecting wetland coverage and storm damage on a county-by-county basis, Carson said. "A storm track moving a couple of kilometers one direction or the other allows the amount of wetland protection to vary within the same county." In terms of property damage, Sun and Carson found that a square kilometer of wetlands saved an average of $1.8 million per year. Over the next 30 years, an average unit of wetlands could save $36 million in storm damage. Some wetlands were valued at less than $800 per year per square kilometer and some at nearly $100 million. That marginal value depended on many factors, including a county's property values, existing wetland coverage, coastline shape, elevation, building codes, and chance of actually experiencing damaging winds. And each of those variables fluctuated over the 20 years the team studied. Overall, the highest-valued wetlands were in urban counties with large populations and the lowest-valued were in rural areas with small populations. However, wetlands provided a greater relative savings against weaker cyclones and in counties with less stringent building codes — areas that might not expect or plan for a tropical storm. The team found no significant difference in the marginal value of saltwater versus freshwater wetlands or mangroves versus marshes. "Forested wetlands tend to be better at reducing wind speed and marshes tend to be better at absorbing water," Carson said, "so the specific nature of the storm when it hits an area is likely to matter. [But] our results suggest that, on average, there is no difference." The team published these results in *Proceedings of the National Academy of Sciences of the United States of America* on March 3.

Wetlands at Risk

Most areas that have experienced storm-related property damage in the past 20 years have also lost wetland coverage, the researchers found. They calculated that Floridians would have been spared $480 million in property damage from Hurricane Irma alone had the state's wetland coverage not shrunk by 2.8% in the decade prior. Moreover, recent changes to the Clean Water Act have made the remaining coastal wetlands more vulnerable. "The federal government, with respect to the U.S. Clean Water Act, took the position that the previous wetland studies

were not reliable enough for use in assessing the benefits and cost of protecting wetlands," Carson said. "The value coastal wetlands provide for storm protection is substantial and should be taken into account as policy makers debate the Clean Water Act," Sun said. "It's also worth noting," she added, "that storm protection for property is just one of many ecological services that wetlands provide. We hope our study will spur future research quantifying these other services as well." With tropical storms and hurricanes expected to happen more often because of climate change, the team wrote, wetlands will be more economically valuable than ever.

therevelator.org, 12 March 2020

https://www.revelator.org

Q&A: Are the 2019-20 locust swarms linked to climate change?

2020-03-10

Though the region has seen locust plagues since biblical times, the scale of the current outbreak is the largest seen in 25 years in Ethiopia and Somalia – and in 70 years in Kenya.

The past few months have seen locust swarms as large as entire cities sweep across countries in East Africa and surrounding regions. With each insect able to eat its two-gram body weight in food each day, it is estimated that the swarms of billions are devouring enough crops to threaten the food supply of millions of people. Though the region has seen locust plagues since biblical times, the scale of the current outbreak is the largest seen in 25 years in Ethiopia and Somalia – and in 70 years in Kenya. Some media reports have pointed to a possible link between the current outbreak and climate change. In particular, they have suggested that the plague has been worsened by recent heavy rains and unusual storm activity in the East African region. These impacts are linked to the "Indian Ocean Dipole", a climate system that affects weather from East Africa to western Australia. In this Q&A, Carbon Brief speaks to scientists to ask how climate change is affecting the Indian Ocean Dipole, and whether it is the climate or other factors that are behind the current locust outbreak.

Is East Africa's current locust outbreak unprecedented?

For months, locust plagues stretching tens of kilometres in length and breadth have blighted central and eastern Africa, the Middle East and parts of Asia, including Pakistan and India. The swarms first arrived in the Horn of Africa at the end of summer 2019. They had moved in from the Arabian desert, where good breeding conditions in the months prior had allowed them to multiply by an astonishing 8,000-fold, according to the UN's Food and Agricultural Organization (FAO). In the autumn months of

2019, the insects spread further inland from Somalia and Ethiopia into countries including Kenya and Uganda. In Kenya, the FAO's locust watch service identified one swarm that was up to 60km long and 40km wide – roughly the size of Luxembourg. The swarm was made up of up to 20bn individual locusts, officials said. At the same time, locusts moved from the Arabian desert into Middle Eastern countries, such as Iran, Bahrain and Kuwait, and into parts of Asia, such as India and Pakistan. By January and February of this year, the locusts had moved into Eritrea and threatened to spread further to Sudan, parts of the Democratic Republic of the Congo and Tanzania. China has also begun to brace itself for a possible outbreak. They have devoured hundreds of kilometres of crops across East Africa, including in the Rift Valley. This could have particularly "severe consequences", the FAO says, given the region is home to almost 12 million food-insecure people. In Ethiopia, the swarms also caused a plane to veer off course after insects slammed into its nose, engine and windshields. In its latest update on 2 March, the FAO's locust watch service said the threat from locusts currently remains high in East Africa, parts of the Middle East and Pakistan. It also warned of large increases in locust numbers in the coming months. Parts of East Africa including Kenya and Somalia could see 400-fold increases in swarm sizes by June as the insects reproduce once again. The map below, provided by the FAO locust service, shows where insect numbers are likely to increase between March and June. The FAO has estimated that the current outbreak is the largest seen in 70 years in Kenya and in 25 years in Somalia and Ethiopia. Pakistan officials say the outbreak there is the worst in 30 years. Yearly records on the number and size locust outbreaks are not readily available for countries in East Africa, Keith Cressman, a senior locust forecasting officer at the FAO, tells Carbon Brief. This makes it difficult to establish if the current outbreak in East Africa is truly unprecedented. The FAO does keep data on the number of countries reporting locust swarms each year globally. This is shown on the chart below, which includes the number of countries reporting locust plague "onset" (black), "peak" (purple) and "decline" (pink) from 1900-2019. Countries report a plague "onset" when locusts are beginning to breed, plague "peak" when they have experienced heavy and widespread outbreaks for more than a year and plague decline when numbers begin to fall again, according to the FAO. (The chart also shows the number of countries each year reporting locusts at low densities in yellow.) This chart shows that 2019 was not a record-breaking year for locust outbreaks worldwide – and that the world saw much larger plagues in the 20th century than in recent times. However, it is worth noting that the factors driving locust swarms are largely regional – and global trends in locust outbreaks would, therefore, not be expected, scientists

tell Carbon Brief. (The factors driving locust swarms are discussed in more detail below.)

How is the current locust outbreak linked to climate conditions?

Some media reports have pointed to a link between the current outbreak and unusual storm and rainfall activity around East Africa. To understand how the cyclones and the outbreak are linked, there is a need to first understand desert-locust biology, explains Dr Philipp Lehmann, a researcher of insects and the environment from Stockholm University. Desert locusts are "biphasic" animals, meaning they can take on two entirely different forms, says Lehmann. In their "solitary" form, they are drab brown in colour and relatively harmless to crops. But, under certain conditions, the insects can switch into a "gregarious form" – turning electric yellow and displaying swarming behaviour. The Arabian Peninsula – the land mass between East Africa and Asia comprising Saudi Arabia, Yemen, Oman, Kuwait, Qatar, Bahrain and the United Arab Emirates – was struck by several unusually severe cyclones between 2018 and 2019. When the first storm – Cyclone Mekunu – hit the Arab peninsula in May 2018, it filled a vast desert near Yemen and Oman, known as the Empty Quarter, with freshwater lakes. The moisture caused lush vegetation to grow in the usually barren environment, attracting desert locusts hunting for food into the area, Lehmann tells Carbon Brief. "The first cyclone lead to this emergence of optimal breeding grounds for the locusts." Desert locusts only switch to a gregarious form when they reach high enough numbers in a certain area, explains Dr Cyril Piou, a locusts researcher at France's Agricultural Research for Development Centre (CIRAD). He tells Carbon Brief "Once they reach a certain density, they start to touch each other a lot and this triggers them to change their behaviour." By the time that the second storm – Cyclone Luban – arrived in the same region in October, the locusts had just hit a critical point where they had started to multiply rapidly, says Lehmann: "It was actually the second cyclone that was the big problem because the locusts were at a point where they had the ability optimise their reproductive capacity to produce a new front of migrating locusts." Spurred on by the ample food supply provided by the cyclones' rains, the locusts multiplied rapidly – increasing their numbers 8,000-fold in just a few months. The unusually rainy period was then followed by a particularly mild winter, which allowed the locusts to survive in large numbers, says Lehmann. Then, in the summer of 2019, the insects began to migrate from the Arab peninsula into the horn of Africa. As the insects moved through East Africa, the region was hit by unusually wet conditions and more cyclones – allowing the swarms

to grow even larger, says Lehmann. Across the Horn of Africa, rainfall between October and mid-November was 300% above average. In Kenya, rainfall was up to 400% higher than average. Overall, the Horn of Africa was hit by eight cyclones in 2019, the largest number in any year since 1976. As well as providing the conditions needed for vegetation growth, cyclones could also worsen outbreaks by providing winds for the locusts to hitch a ride on, says Lehmann: "Winds can definitely push insects in great numbers over great distances – and at quite a small energetic cost, meaning that they have more energy available for reproduction." The unusual wet weather in East Africa is linked to a wider climate system known as the Indian Ocean Dipole (IOD). The dipole affects weather on both sides of the ocean, from East Africa and the Arab Peninsula to Indonesia, Papua New Guinea and Australia. (The IOD also sometimes referred to as the "Indian Niño" because of its similarities to El Niño in the Pacific.) The dipole, which was formally identified in 1999, has three phases – positive, negative and neutral. Events typically develop in the northern hemisphere summer, peak in the autumn and then decline rapidly in winter. However, events can also stay put for extended periods. In a neutral dipole phase, waters around Indonesia, Papua New Guinea and Australia are warm, which causes air to rise up and fall as rain. Winds blow in a westerly direction. In this phase, the dipole has very little effect on temperatures in countries surrounding the Indian Ocean. The diagram below illustrates what occurs in a neutral phase. During a positive phase, however, this pattern reverses. Westerly winds weaken and, sometimes, easterly winds form – dragging warm water towards the Arab Peninsula and the Horn of Africa. This, in turn, plays a role in driving cyclones and heavy rainfall in the region. Cyclone frequency increases during a positive dipole phase because the additional warmth and moisture brought by the climate system acts as fuel for budding storms. The diagram below illustrates the impacts of a positive IOD phase. The IOD was in positive phase in the June to December period of both 2018 and 2019. In 2019, the dipole reached its most extreme positive level in 40 years. As well as driving rains in East Africa, the strongly positive dipole also played a role in driving Australia's unprecedented 2019-2020 bushfires. This is because rains shifted towards East Africa, leaving Australia with drought-like conditions. (A recent analysis by the World Weather Attribution initiative found the conditions for fire in Australia were made "much more severe" by the positive dipole phase.)

Is climate change affecting the Indian Ocean Dipole?

Some people have suggested that the extreme wet weather seen during the 2018 and 2019 dipoles could be linked to climate change. António Guterres, the UN's secretary general, recently said in a statement: "There is a link between climate change and the unprecedented locust crisis plaguing Ethiopia and East Africa. Warmer seas mean more cyclones generating the perfect breeding ground for locusts. This is getting worse by the day." The extreme positive dipole in 2019 certainly does fit into a picture of long-term change, says Dr Wenju Cai, director of the Centre for Southern Hemisphere Oceans Research at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia. He tells Carbon Brief: "It's highly likely that the event that we've just seen has a very strong warming component in it – but attributing individual events to long-term climate change is not a simple issue." To understand how the dipole is changing, scientists study something known as the "dipole mode index" – which is the difference between average sea-surface temperatures in the western Indian Ocean and the eastern Indian Ocean, explains Cai. During a positive phase, temperatures in the western Indian Ocean are higher than in the eastern Indian Ocean – giving an overall positive index. The chart below shows how the monthly dipole mode index changed from January 1979 to December 2019. The chart shows how the mode index reached its highest recorded level in the northern hemisphere winter of 2019, the time when East Africa was hit by heavy rains and unusual cyclone activity. The dipole was also positive in 2018, when the Arab peninsula was struck by several cyclones – though this dipole was less extreme, Cai says. Looking back over longer timescales, it is clear that the dipole mode index has been "rising up steadily", he adds: "There is always a role for natural variability, but we think this is due, in a large part, to climate change because this persistent trend of 60-70 years is not fully consistent with, for example, decadal variability, which would have gone up and down over a 70-year period." A 2009 study led by Cai found that positive phases of the dipole have increased in frequency since the 20th century. In the early 20th century, a positive dipole phase occurred roughly four times in a 30-year period. However, in the 30-year period spanning 1989-2009, there were 10 positive dipoles. A study published this week in Nature reinforced the finding that positive dipole events are becoming more frequent. It looked at ancient coral records stretching back to 1240 and found that positive dipole events that were once rare in the ancient world and now commonplace. Climate change could be skewing the dipole in favour of positive phases because the western Indian Ocean – near Africa – is warming at a faster rate than the eastern Indian Ocean, Cai explains: "With the western Indian Ocean warming faster, it's easier for the temperature difference between the west and the east to become very large. And, so,

it's much easier to have the rising air that brings rain happening in the western part of the Indian Ocean." Further analysis by Cai and colleagues found that uncontrolled future climate change could cause positive dipole events to increase by a factor of three by 2099, when compared to the period 1900-1999. Even if global temperature rise is limited to 1.5C – the aspirational target set by the Paris Agreement – the number of positive dipole events could double, when compared to the pre-industrial era, according to another study. Such increases are likely to bring about more frequent and intense cyclones, says Dr Agus Sontoso, a senior research associate at the Climate Change Research Centre at the University of New South Wales in Sydney. He tells Carbon Brief: "The Indian Ocean itself is warming everywhere. So it's reasonable to think that under climate change, we expect to see more frequent, if not stronger, cyclones in the region." Though the rainy weather played a role in driving the current locust outbreak, there are several factors that could have contributed to the insects' spread, scientists tell Carbon Brief. One major factor is that countries did not act quickly enough to prevent the locusts from spreading in 2018, says Piou: "This specific crisis is also due to the fact there was no preventative management in many of the places where the rain fell. Saying it's directly linked to climate change is too simple – it's forgetting that we should have been preventing the outbreak in the first place." According to the FAO, the best way to stop locusts from spreading is to spray small concentrated areas with pesticides. This is most effective early on in an outbreak, when the insects are still multiplying, says Piou. The responsibility of controlling locust numbers falls to national governments – with international organisations stepping in during outbreak and crisis situations. The insects first started to multiply in the south of the Arab peninsula, a region experiencing political instability and conflict. This may have thwarted early detection and prevention methods, says Lehmann: "There's actually some studies on this – though not in an African context. I've worked a lot with the Colorado potato beetle, which arrived in Europe during the first world war. Before the war, it was contained by early prevention efforts. During the first world war, people had other things on their mind – the potato beetle arrived, established itself and started spreading. Then, during the interwar period of the 20s and 30s, the spread was quite contained. But during the second world war, there was the biggest spread that we've ever seen." It is worth noting that other parts of Africa, including Niger and Mauritania, periodically experience heavy rains, but do not see outbreaks on the same scale, says Piou: "The prevention system is working in some other parts of the world. For example, in western Africa, they experience heavy rains that arrive and create some good conditions for the desert locust to breed and multiply –

but they don't see such large outbreaks." Another possible driver influencing the current outbreak could be an increase in irrigated agriculture in parts of East Africa, says Lehmann: "People live year-round in these semi-arid areas and you need irrigation in order to maintain crops. This also creates stopping points for a swarm." Overall, it is likely that several factors worked in tandem to make the current outbreak so extreme, says Lehmann: "I think there can be several reasons for why an outbreak starts and, in many ways, it's like the stars have to align – and, when they do, something very bad happens." Though studies suggest that the wet conditions seen in Africa during the winter 2019 are likely to become more frequent with climate change, it is less clear if there will be a corresponding increase in locust outbreaks, scientists tell Carbon Brief. This is because many factors influence the chance of an outbreak, including human factors such as taking early preventative measures, says Piou: "If there are more cyclones in the Arab peninsula, then eventually, yes, there could be more outbreaks. But still, in any case, the main message should be to be prepared for that with a preventative system." It is likely that locust outbreaks will "stay bad" in East Africa, says Lehmann "I think they will stay bad – as they are. I base this simply on the fact that locusts are cyclic and there have been outbreaks for thousands of years. If they return, I think there can be several reasons for why an outbreak starts." The "jury is still out" on how future temperature rise in the East African region could affect outbreaks, he adds. (According to Carbon Brief analysis, temperatures around the horn of Africa could increase 1.6-4.6C by 2100, depending on the rate of future greenhouse gas emissions.) Research suggests that desert locusts do prefer hotter temperatures, says Piou: "The perfect temperature for a desert locust to multiply is around 35C during the day. And even below this temperature, they display warming up behaviours to reach a body temperature of 40C, which is the optimal temperature for their metabolism." However, despite hotter temperatures giving the insects a physiological advantage, it is not yet clear if this would influence their swarming behaviour, says Lehmann. Overall, climate change is expected to make weather conditions in East Africa less predictable – which is likely to benefit insect pests, he adds: "I don't know if it's the locusts, per se, or some other pests that will respond – but insect pests generally thrive in unpredictable environments."

carbonbrief.org, 10 March 2020

https://www.carbonbrief.org

Second 'cured' HIV patient goes public

2020-03-09

A 40-year-old former chef, Adam Castillejo, has revealed to ***The New York Times*** that he is "the London patient," only the second person in the world that physicians believe has been cured of an HIV infection. The medical intervention that apparently cured both people is not widely applicable at this time, however. Castillejo's doctor first described the London patient last year at an HIV/AIDS conference and in a *Nature* paper. At the time, no HIV had been detected in Castillejo's blood for 18 months after a stem cell transplant to treat a life-threatening blood cancer, but his doctor was reluctant to call him cured. A similar procedure, which used bloodmaking stem cells with a mutation that made the cells highly resistant to HIV infection, led to the first cure in 2007. That transplant recipient, Timothy Ray Brown (initially known as "the Berlin 'patient"), has been counseling Castillejo about the impact of going public. "The long-term control of HIV in this patient suggests that the Berlin patient is not a one-off case," stem cell researcher Deng Hongkui of Peking University tells *Science*. Deng last year reported in *The New England Journal of Medicine* his group's attempt to do a similar experiment, which used the genome editor CRISPR to modify a donor's stem cells and mimic the natural mutation, but it did not work.

sciencemag.org, 9 March 2020

https://www.sciencemag.org

At the time, no HIV had been detected in Castillejo's blood for 18 months after a stem cell transplant to treat a life-threatening blood cancer, but his doctor was reluctant to call him cured.

Air pollution 'pandemic' shortens lives by 3 years: study

2020-03-03

A 'pandemic' of air pollution shortens lives worldwide by nearly three years on average, and causes 8.8 million premature deaths annually, scientists said Tuesday. Eliminating the toxic cocktail of molecules and lung-clogging particles cast off by burning oil, gas and coal would restore a full year of life expectancy, they reported in the journal Cardiovascular Research. "Air pollution is a larger public health risk than tobacco smoking," lead author Jos Lelieveld of the Max Planck Institute in Mainz, Germany told AFP. "Much of it can be avoided by replacing fossil fuels with clean renewable energy." Compared to other causes of premature death, air pollution kills 19 times more people each year than malaria, nine times more than HIV/AIDS, and three times more than alcohol, the study found. Coronary heart disease and stroke account for almost half of those deaths, with lung diseases and other non-communicable diseases such

as diabetes and high blood pressure accounting for most of the rest. Only six percent of mortality stemming from polluted air is due to lung cancer. "Our results show there is an 'air pollution pandemic'," said senior author Thomas Munzel of the Max Planck Institute's departments of chemistry and cardiology. "Both air pollution and smoking are preventable, but over the past decades much less attention has been paid to air pollution than to smoking, especially among cardiologists." The worst-hit region is Asia, where average lifespan is cut 4.1 years in China, 3.9 years in India, and 3.8 years in Pakistan. In some parts of these countries, toxic air takes an even steeper toll, other research has shown. In India's Uttar Pradesh -- home to 200 million -- small particle pollution by itself slashes life expectancy by 8.5 years, while in China's Hebei Province (population 74 million) the shortfall is nearly six years, according to the Air Quality Life Index, developed by researchers at the Energy Policy Institute of Chicago. African lives are also foreshortened by 3.1 years on average, with people in some nations -- Chad, Sierra Leone, Central African Republic, Nigeria and Cote d'Ivoire -- losing 4.5 to 7.3 years. Among wealthier nations, the Soviet Union's former satellite states have the deadliest pollution, especially in Bulgaria, Hungary and Romania. "We show that about two-thirds of premature deaths are attributable to human-made pollution, mainly from fossil fuel use," Munzel said. "This goes up to 80 percent in high-income countries," he added. "5.5 million deaths worldwide a year are potentially avoidable."

Impact 'significantly underestimated'

Unavoidable excess mortality stems from natural dust storms, such as in central Asia and northern Africa, along with forest fires, though both phenomena are being amplified by manmade climate change, according to climate scientists. The least-impacted regions of the world are the Americas, western and northern Europe, and small island states. The figure of 8.8 million premature deaths from outdoor air pollution each year is double estimates from World Health Organization (WHO). "The impact of air pollution on cardiovascular and other non-communicable diseases was significantly underestimated," Lelieveld explained, echoing a conclusion from other recent research. Air pollution causes damage to the blood vessels through greater oxidative stress, leading to increases in blood pressure, diabetes, stroke, heart attacks and heart failure. The revised number for China is 2.8 million premature deaths each year, two-and-a-half times the WHO estimates. The researchers said there are signs in India, China and other emerging economies that people are growing intolerant of life-shortening toxic air. "The realisation that air pollution is a major health risk can contribute to the willingness to phase-out fossil fuels --

with the co-benefit of reducing climate warming," Lelieveld said. To assess the impact of air pollution on life expectancy, the researchers applied data on exposure to micro-particles (PM2.5) and ozone for the year 2015 to models that simulate how chemical processes in the atmosphere interact with natural and manmade pollutants, and data from the Global Burden of Disease. Indoor pollution -- mainly from cookstoves fuelled by biomass or coal -- is also a major killer, but was not considered here.

france24.com, 3 March 2020

https://www.france24.com

Fishing trawlers could harm water quality by disrupting seafloor microbes

2020-03-03

Fishing boats that drag nets along the sea floor to catch seafood can indiscriminately harm marine life and destroy habitat. Now, a new study suggests "bottom trawling" can also disrupt the ability of microbes in sediment to remove excess nutrients in coastal waters, potentially increasing that pollution. "This is one of the first papers to look at actual biogeochemical effects of bottom trawling," says Sebastiaan van de Velde, a marine biogeochemist at the University of California, Riverside, who was not involved. "The whole angle is very novel." Nitrogen is a vital nutrient for aquatic plants such as kelp and tiny marine algae known as phytoplankton. But too much—as comes with poorly treated sewage or fertilizer washing off farm fields—stimulates so-called algal blooms. The excess algae can be a nuisance, tangling boat propellers and rotting on beaches. And when the algae die in the water, things get worse: Microbes that break it down gobble up oxygen and can create a dead zone that suffocates fish and other marine creatures. Microbes in seafloor sediment can help prevent this problem by converting excess nitrogen into an inert gas that escapes into the atmosphere. Could bottom trawling interfere? To find out, Bradley Eyre, a biogeochemist at Southern Cross University, and his colleagues conducted an experiment in Moreton Bay, Australia. The team selected three sites near a river that delivers nitrogen into the bay. Then, several times in 1 year, they measured the nitrogen gas coming from the sediment. This gas is the end-product of a process, called denitrification, in which microbes in the top few centimeters of sediment decompose nitrogen-rich organic matter. The process requires a special set of conditions because some of the biochemical reactions require oxygen, whereas some demand its absence. On the sea floor, this patchwork of conditions is created by the burrowing of many kinds of marine animals,

Now, a new study suggests "bottom trawling" can also disrupt the ability of microbes in sediment to remove excess nutrients in coastal waters, potentially increasing that pollution.

such as crustaceans, clams, and worms. Next, Eyre and his colleagues hired a shrimp trawler. They got permission for the boat to drag its net across several sites in an area protected from trawling. Immediately afterward, divers jumped into the water to study the sediment and measure the nitrogen gas emitted by microbes. As expected, the trawling mixed the sediment on the sea floor. This erased the fine structures created by burrowing animals, hindering the microbes and cutting the nitrogen gas they emitted by up to 50% compared with nearby untrawled sites, the team reported last month in *Limnology and Oceanography Letters*. "It's actually a pretty big effect," Eyre says. Van de Velde agrees. "You're completely changing how these bottom sediments function," he says. "That is a major problem with bottom trawling." Eyre and colleagues repeated the experiment three times, once every 3 months, and saw the same effect. The good news is that after each trawl, burrowing animals returned and re-created the conditions for denitrification. One worrying sign is that each trawl decreased denitrification more than the previous trawl. This suggests lasting damage, but the trend was not statistically significant. The results could be conservative. Because the water was only 4 meters deep, strong waves regularly disturbed the sediments, which would regularly decrease denitrification. Eyre thinks trawling might have a relatively greater impact on denitrification in deeper waters where animal burrows are more stable. The overall amount of denitrification is probably greater in shallow water, however, because more organic matter is present there. It's difficult to say how large an impact trawling has on denitrification and water quality. Eyre and his colleagues made some rough calculations. Assuming trawling occurs in half of Moreton Bay, for example, and has the maximum impact measured in the experiment, it could prevent 5477 tons of nitrogen from escaping from the water and sediment. That's equivalent to 80% of the nitrogen that enters the bay from air and land each year. "It's just to show how potentially important this could be," Eyre says. The new study "certainly provides an important piece of the puzzle," says Marija Sciberras, a marine ecologist who will soon join Heriot-Watt University, Edinburgh. Given the broad extent of trawling, she adds, figuring out its impact on the nutrient cycle is an urgent task.

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https://www.sciencemag.org

One study, for example, found that thirdhand smoke lingers in vacant homes up to 2 months after smokers move out; another found that it remained in a casino for 6 months after a smoking ban.

'Thirdhand' smoke can expose moviegoers to the emissions of up to 10 cigarettes

2020-03-04

Scientists have warned about the dangers of secondhand smoke for decades. And in recent years, a variety of smoking bans have saved nonsmokers from passively sucking in harmful cigarette chemicals. But a new study finds that even those restrictions might not be enough: Compounds from tobacco smoke can infiltrate well-ventilated, nonsmoking rooms and even movie theaters by hitching a ride on peoples' clothes, skin, and hair. The findings are "fascinating," says Georg Matt, a psychologist at San Diego State University who has spent 20 years studying thirdhand smoke—chemicals left behind on surfaces from tobacco fumes. He and his colleagues, who were not part of the new study, have long wondered why indoor areas with smoking bans are often contaminated with cigarette chemicals. One study, for example, found that thirdhand smoke lingers in vacant homes up to 2 months after smokers move out; another found that it remained in a casino for 6 months after a smoking ban. But most studies look at indoor spaces that were recently smoked in. The new work focused on a movie theater in Mainz, Germany, that has had a strict smoking ban for 15 years—enough time for the preban contaminants to clear out, says Drew Gentner, an environmental engineer at Yale University and the study's lead author. To determine the quality of air in the theater, he and his colleagues placed a mass spectrometer—a machine that measures chemicals—by one of the theater's ventilation ducts. The device monitored the air as patrons filed in and out of the theater and watched a variety of films. Over the course of 4 days, the researchers found sharp spikes in 35 tobacco-related chemicals, including toxic compounds such as benzene and formaldehyde, when audience members entered the theater, the team reports today in *Science Advances*. Given the theater's strict ban on smoking, the only way the contaminants could have made their way in was by sticking to the clothes and bodies of audience members who had been around smoke prior to entering. When the theater showed R-rated movies such as *Resident Evil*, levels of thirdhand smoke compounds were up to 200% higher than they were during viewings of the G-rated family movie *Wendy*. That's because the R-rated films attracted older viewers, who were more likely to have recently encountered cigarette smoke, the researchers say. Over the course of a typical R-rated film, audience members were exposed to the equivalent emissions of one to 10 cigarettes of secondhand smoke, Gentner says. Matt says these findings suggest cigarette smokers—or people who have been exposed to smoke—are carrying the compounds

with them and depositing them as they slowly evaporate. The process, known as "off-gassing," is the reason why smokers smell like cigarettes, explains Peter DeCarlo, an expert in air pollution at Johns Hopkins University, Baltimore, who was not involved in the study. "You're not smelling the chemicals that are bound to the person's clothes," he says. "You're smelling the ones that are coming off." All of this means that hazardous pollutants in tobacco smoke likely put nonsmokers at some risk—though just how much is unknown, the researchers say. (The harmful effects of secondhand smoke are firmly established.) They expect exposure to thirdhand smoke is an even bigger problem in confined and poorly ventilated spaces, such as subway cars and small rooms in people's homes. DeCarlo hopes studies like this will raise awareness of the toxins that could be present even in smoke-free buildings. Meanwhile, Matt says it might be unrealistic to expect smokers or those who have been around smokers to shower and wash their clothes before going to shared spaces. "The only solution … is to reduce smoking rates."

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https://www.sciencemag.org

How Are Medical Devices Making Consumers More Environmentally Conscious?

2020-03-02

Sustainability isn't the job of a single person, business or industry. It's going to take a collaborative effort to combat the effects of climate change and move toward a better future for the environment. You don't have the sole responsibility to save the planet. Preserving the environment requires a system of accountability. The public needs to hold industries to a high standard for their environmental impact, and companies need to provide people with the means to live sustainably. The medical industry doesn't have the best track record when it comes to environmentalism. The U.S., Australian, Canadian and English medical sectors collectively contribute 748 million metric tons of emissions every year. However, some healthcare companies are taking steps to reduce that. On top of cleaning up their own operations, these companies are providing ways for consumers to go green. The makers of medical devices are leaning into sustainable accountability to help you become a more environmentally conscious consumer. Here are a few of the ways medical devices are helping people do that.

You don't have the sole responsibility to save the planet.

Offering Up Transparency

One of the ways medical device manufacturers are creating eco-conscious consumers is by being transparent about their materials and processes. Many companies don't publicize aspects of their manufacturing to hide their unsustainable practices. By opting for transparency, manufacturers tell consumers exactly what they're supporting when they buy certain products. MedTech Europe has taken up a policy of full material declaration, meaning it's open about all the materials found in its products. Manufacturing giant Siemens has also adopted a substance transparency policy as part of their broader "Product Eco Excellence" program. These declarations allow you to see not just the elements that are in these products, but how much of them.
This information allows you to understand the ecological impact of each device better. In turn, you become a more knowledgeable consumer.

Providing Recycling Options

Traditionally, medical devices come in disposable plastic packaging. These packages are cheap and convenient, but they aren't the most eco-friendly thing on the planet. This waste can endanger animals and cause pollution, and recycling some materials can be a complex process most

people can't do on their own. Albumin, a protein used to replace lost fluids, usually comes in bulky glass bottles, but Baxter has started shipping it in flexible plastic packaging. The new packages use substantially less material, leading to less waste. The smaller mass allows recycling plants to dispose of it faster and more easily. Some companies, like Roche Diabetes Care, offer services to help recycle their product packaging. The Swiss company's insulin pump tubing comes in Tyvek plastic, which needs specialists to recycle correctly. By providing customers the means to send their packaging to a recycling center, they can make sure the materials don't end up in a landfill.

Bringing HealthCare Home

Not every hospital visit is an emergency. Regular checkups and physicals are an essential part of living a healthy life, but frequent trips to the doctor come at a cost. Most people don't drive zero-emissions vehicles, so every time they operate their car, they release harmful exhaust fumes into the air. You should be seeing a doctor, but you also should try to keep your emissions in check. Modern devices allow you to do both. With the help of telemedicine equipment and services, you can conference with healthcare professionals without leaving home. These devices allow you to consult a doctor about any number of issues from the comfort of your couch. That way, you minimize your emissions by leaving your car in the garage.

Sustainable Manufacturing

Even if a product is efficient, buying it may not be as green a practice as you might think. The manufacturing process across all industries is notorious for generating emissions and waste, so purchasing a new product of any kind may be harmful to the environment. Cleaner methods of production are helping solve that problem. Researchers are looking into 3D-printed artificial organs, which increase sustainability. Since 3D printing adds material instead of cutting it away, it's generally a more eco-friendly manufacturing method. 3D-printed medical implants may seem like something out of science fiction, but it's not a distant possibility. These printing techniques are already widespread, and researchers are getting closer every day to accurately replicating body tissue. By offering these devices, companies can help consumers make environmentally conscious purchases.

Longer Lifecycles

Waste management is one of the biggest challenges facing eco-friendly initiatives. People tend to throw things away, often carelessly, instead of reusing or recycling them, leading to crowded landfills. Even if they do, an influx of disposed-of items can back up recycling plants. These issues wouldn't be as prevalent if products were usable for longer periods, which is precisely what medical device manufacturers are pursuing. By creating devices that consumers can use for longer, these companies reduce the frequency at which their products get thrown away. This longevity leads to less pollution and a more manageable workload for recycling plants.

Promoting Eco-Friendly Behavior

If nothing else, medical device manufacturers are fostering eco-friendly consumers by promoting sustainable practices. Conferences like CleanMed showcase the ways healthcare companies are going green, inspiring other businesses and individuals to take similar steps in their work and lives. If you know a medical device brand is environmentally friendly, it may incline you to look for sustainable brands elsewhere, too. These green practices demonstrate that corporations and people alike can live sustainably. By arming people with means and knowledge to go green, medical device makers can guide consumers toward an eco-friendly future. Unfortunately, the sustainability question of how we can build a cleaner earth is not just a medical industry problem, and it's not one that a person can tackle alone. It's an issue for every person, company and government today.

eponline.com, 2 March 2020

https://www.eponline.com

Around them the smoke and air quality were getting steadily worse.

What was actually in the air you were breathing during the bushfire haze?

2020-03-11

Rachael Neumann was six months pregnant with her first child when the smoke in Canberra was at its worst this January. She told 7.30 she was anxious and frightened about what she was breathing in and what it could be doing to her unborn child. "It was just really challenging and really stressful. And with all the hormones as well — there were a couple of days where I just could not stop crying. It was awful," she said. Her husband Shalev Nessaiver was so worried that he started compiling regular updates about the smoke. They became so popular amongst their friends that he started a Twitter feed to share the information he was gathering. "I would

start to look at weather patterns and smoke forecasts and combined a bunch of data to figure out, OK, here's where it's going to be bad during the day, here's where it might be a little bit better," Mr Nessaiver said. "Generating these forecasts became so chaotic because of all the new fires that were springing up. I just built an automated version that pulled data from a couple of different sources and displayed it on a website." Around them the smoke and air quality were getting steadily worse. At one point, the air quality rating in Canberra was more than 22 times the hazardous rating. To escape it, they decided to move to Melbourne. "It got to the point where we were barricading ourselves in our bedroom, sealing the vents and the tops and the bottoms of the doors," Mr Nessaiver said. "We had an air purifier running full blast. We can't live like this, right? You can't. "We just booked flights the next morning and said, 'We cannot be here like this'." At the same time that Ms Neumann and Mr Nessaiver were worrying about their unborn child, University of Wollongong atmospheric chemist professor Clare Murphy was setting up an air monitoring experiment at Lake Cataract, south of Sydney. Her team had not initially been planning to examine bushfire smoke, but she told 7.30 the plume from the Canberra and NSW South Coast blazes proved to be irresistible. "We haven't done much analysis [yet] because we have been so busy keeping the instruments running. But this experiment finishes at the end of March, and the data will keep us busy for months and years to come," she said. Professor Murphy said past work examining hazard reduction burns gave her a strong indication of what millions of Australians were breathing in this summer. "It's not just the particles in the smoke that they need to worry about. There are a lot of toxic gases like formaldehyde, ammonia, hydrogen cyanide," she said. "I could carry on naming, but quite a few." She told 7.30 that masks bought by many Australians would not stop the inhalation of these potentially toxic gases. "I think that the extent of the exposure that we saw in the bushfires this season was unprecedented. And I think we've all been part of a big mass experiment on populations and I think time will tell how bad it is. "These gases are toxic and they're known to attack different parts of the human body. The reason that they're not monitored by air quality monitoring stations is that normally they will be below the detection limit of the instruments that you could easily get hold of. "So in this smoke, they're very elevated and you can see the concentrations quite clearly." Despite this, Professor Murphy is not overly concerned, even though she has been breathing in this air herself. "Air pollution does link in epidemiological studies with poor health outcomes, but it's a statistical thing and it's something that affects people who already have lung problems. "I think that on the plus side, Australians do often enjoy quite good air quality and the lungs, the human body,

is amazing in its ability to recover." Ms Neumann and Mr Nessaiver have no regrets about their decision to move from Canberra to Melbourne. "When we first got here, we were like, 'Wow, this is so different.' Because it had been so long since we'd been able to do that." Mr Nessaiver told 7.30 they were looking forward to meeting their child. "I think it's been a great pregnancy and the baby is 100 per cent OK," he said.

Changes to recovery fund

The Federal Government's National Bushfire Recovery Agency will today announce changes to its $2 billion recovery fund to make it easier for small businesses and primary producers to apply for grants and loans. 7.30 has been told the agency will be broadening the definition of what a "bushfire-affected business" is, meaning that money will not just be flowing to businesses that were physically burned in the fire. The agency's coordinator, Andrew Colvin, has conceded it is currently taking too long to get loans and grants into the bank balances of the victims of this summer›s devastating and deadly fires. A statement from the Minister for Emergency Management, David Littleproud, said the changes would «include a new $10,000 grant, quicker access to existing loans and more boots on the ground to help small businesses access appropriate help». 7.30 also understands changes are being made to the package that is currently available for primary producers to help them get back on their feet.

abc.net.au, 11 March 2020

https://www.abc.net.com=

'UK's first tiny forest' in Witney helps urban environment

2020-03-10

A "tiny forest" - said to be the first of its kind in the UK - is being planted in Oxfordshire in a bid to tackle urban wildlife loss. Six-hundred native trees will fill a 200-sq-m plot - about the size of a tennis court - in Witney, Oxfordshire. The small, fast-growing and dense forest, planted by environmental charity Earthwatch and Witney Town Council, will mimic native woodland. The charity said plans were already under way to create another in Oxford. Tiny forests are based on forest management methods developed in the 1970s by Japanese botanist Dr Akira Miyawaki. The trees, which are being planted by council staff and volunteers, are able to store carbon, soak up water to reduce flooding, attract wildlife, reduce

Six-hundred native trees will fill a 200-sq-m plot - about the size of a tennis court - in Witney, Oxfordshire.

dust, improve air quality and cut noise pollution. Earthwatch is bringing the scheme to the UK with the help of Dutch organisation IVN Nature Education, which has planted nearly 100 tiny forests in the Netherlands.

'Ecological crisis'

Earthwatch Europe's senior research lead, Victor Beumer, said: "We are excited to be planting a tiny forest, the first of its kind in the UK, in partnership with Witney Town Council. "At a time when it seems impossible to overcome the enormous challenge of the climate and ecological crisis, tiny forests offer a collaborative natural solution with far-reaching benefits. "We hope to inspire individuals, businesses and government to take environmental action, by supporting a tiny forest in their local area." Witney town councillor Vicky Gwatkin said: "The global environmental crisis focuses the mind but also provides a tremendous opportunity to think outside the box, giving us the confidence to experiment and try new things. "Tiny forests demonstrate that, far from being a sacrifice, the shift to green can actually provide a range of other community benefits. "It is a privilege for Witney to have the UK's first tiny forest "

bbc.com, 10 March 2020

https://www.bbc.com=

Beetle Larvae Can Survive on Polystyrene Alone

2020-03-11

Scavenger worms have crawled the Earth for 100 million years. From bone-eating worms that fed off plesiosaurs to today's mealworms and maggots that feast on decaying organic matter in the backyard, their diets have moved with the times. As we find ourselves in the midst a plastic pollution crisis, scientists have tested feeding so-called superworms, the larvae of *Zophobas atratus*, Styrofoam, a type of polystyrene. Not only were the worms able to eat the material as their sole diet, but the researchers found that their gut microbiota degraded the polystyrene and converted the complex substance into carbon dioxide, according to findings published March 15 in *Science of the Total Environment*. The research builds on previous studies that found wax worms and mealworms were also able to eat plastic. "It's really interesting now that we're seeing multiple small insects that can eat and degrade polystyrene, as well as a few other types of plastics like polyethylene,"says Anja Malawi Brandon, a PhD candidate in civil and environmental engineering at Stanford University who was not involved in the study. "This is interesting because it's starting to

The research builds on previous studies that found wax worms and mealworms were also able to eat plastic.

paint a picture about what evolutionarily is allowing this to happen. A lot of these insects, such as superworms or mealworms . . . developed over time to be scavengers and eat and break down all sorts of materials that they found, including wood-based material," which is difficult to degrade. An estimated 359 million tons of plastic were produced globally in 2018, including 33 million tons of polystyrene, according to the authors. Polystyrene is particularly difficult to biodegrade due to its recalcitrant macromolecular structure. The material is often discarded without recycling, making it one of the major plastic debris accumulated in the environment. Several years ago, researchers from the School of Life Science, Beijing Institute of Technology in China studied larvae of the mealworm beetle, *Tenebrio molitor*, and reported that the worms were able to degrade and mineralize Styrofoam, confirming that the gut bacteria broke down the polystyrene. In their latest project, the team turned to superworms, a name indicative of their impressive size and large appetite. They wanted to see if the superworm was also capable of digesting and breaking down Styrofoam. At 3–6 cm long, the larvae are four times the size of mealworms, which could mean they'd be effective plastic scavengers. Indeed, when the worms were fed polystyrene, the average consumption rate was about 0.58 mg per day, which was four times more than what the mealworms had eaten. The team fed one group of superworms Styrofoam as their sole diet and another group a normal diet of bran over a 28 day period. To test how the worms digested the polystyrene, the researchers analyzed the frass, or excrement. Using gel permeation chromatography and two types of spectroscopy, the group found that the worms had depolymerized the long-chain polystyrene molecules into low molecular-weight products. The researchers also put the superworms in two different glass incubators, one with those that had been fed Styrofoam and another with worms that had not been fed anything. The incubators were sealed with rubber stoppers and filled with compressed air lacking carbon dioxide. The scientists collected any carbon dioxide that was produced and subtracted the amount made by the unfed worms from that of the Styrofoam-eating worms. A respirometry test showed that the superworms had converted 36.7 percent of the ingested Styrofoam into carbon dioxide. The superworms' microbiota contributed to the Styrofoam's breakdown. The team used antibiotics to suppress the worms' gut microbiome and reported that this inhibited their ability to degrade the plastic. "It is definitely exciting to think about how we could harvest bacteria from these [worms'] guts, grow them in isolation from the insects, and then get them to degrade plastics a little bit more broadly," says Brandon. In their paper, the researchers in Beijing write that they hope their findings could "open a new way for harnessing mealworms to

degrade . . . other types of [materials], such as polyethylene or rubber." In particular, this type of research could guide the search for an enzyme from these worms' guts that degrades plastic and that could be scaled up and commercialized. Yu Yang, who led the Beijing group, is working towards this goal. "Now we are isolating a few bacteria from the gut of superworms and testing their plastic-degrading capability," he tells *The Scientist* in an email. "I'm very hopeful that we will identify the enzymes capable of [degrading the plastic] and eventually develop a biotech tool kit," agrees Federica Bertocchini, a developmental biologist at the Margarita Salas Center for Biological Research in Madrid, Spain, who was not involved in the study. Mealworms and superworms are often used as a pet food for animals such as birds and reptiles, due to their high protein and fat content. In December, Brandon and her colleagues found that mealworms were able to eat polystyrene that included a common toxic flame retardant, hexabromocyclododecane (HBCD), and still serve as a safe food for other animals. The team found that mealworms fed HBCD-laden polystyrene were just as healthy as the worms that had a normal diet, and the shrimp that ate the polystyrene-fed worms were healthy as well. She says she and her colleagues were shocked by the results, as they had suspected that chemicals such as HBCD would bioaccumulate in the shrimp. Whether these scavenger worms have evolved and adapted to their surroundings to consume new materials or whether they've had such abilities to digest plastics all along is unclear. "It could just be fortuitous that these insects already had an enzyme that could start that process," says Brandon. "Plastic represents a lot of energy. They have a lot of carbon and energy for whatever bacteria or organism out there that can access it. So it makes sense that there could be some sort of evolutionary drive to break down these high energy, dense products."

the-scientist.com, 11 March 2020

https://www.the-scientist.com=

Liquid metal that floats on water could make transformable robots

2020-03-05

A liquid metal alloy less dense than water has been made by injecting the material with glass beads – and it could be used to make lightweight exoskeletons or transformable robots.

The shape-shifting robots from *Terminator 2* may be in for a reboot on the high seas. A liquid metal alloy less dense than water has been made by injecting the material with glass beads – and it could be used to make lightweight exoskeletons or transformable robots. Like mercury, which has the lowest melting point of pure metals at -38.8°C, liquid metal alloys don't solidify at room temperature. They are also eutectic, meaning that they

melt at a lower temperature than the individual melting points of the metals they are made from. Jing Liu at Tsinghua University in China and his colleagues have created such a material by mixing pure gallium and indium to create a liquid metal alloy with a melting point of 15.7°C. To decrease its density, they stirred tiny glass bubbles filled with air into the liquid. The loose beads, which were 75 micrometres in diameter or smaller, clustered together in the mixture. Oxygen mixes in with the liquid metal, which helps the glass beads stay suspended, says Liu. Those beads decreased the density of the gallium-indium alloy by up to 97 per cent without altering its other properties – it has high electrical conductivity and it can be shaped and deformed without breaking. These features make it ideal for making exoskeletons that aren't too heavy for practical use, or flexible robots that could transform depending on temperature, says Liu. Depending on the size of glass beads used, the liquid's density varied between 0.45 grams per cubic centimetre – less than half the density of water – and 2.01 grams per cubic centimetre. He says this could come in handy for controlling the buoyancy of underwater devices. The team plans to test the effect of using different variations of beads, such as glass beads with a vacuum inside instead of air, or plastic beads.

newscientist.com, 5 March 2020

https://www.newscientist.com=

Tropical forests losing their ability to absorb carbon, study finds

2020-03-05

Tropical forests are taking up less carbon dioxide from the air, reducing their ability to act as "carbon sinks" and bringing closer the prospect of accelerating climate breakdown. The Amazon could turn into a source of carbon in the atmosphere, instead of one of the biggest absorbers of the gas, as soon as the next decade, owing to the damage caused by loggers and farming interests and the impacts of the climate crisis, new research has found. If that happens, climate breakdown is likely to become much more severe in its impacts, and the world will have to cut down much faster on carbon-producing activities to counteract the loss of the carbon sinks. "We've found that one of the most worrying impacts of climate change has already begun," said Simon Lewis, professor in the school of geography at Leeds University, one of the senior authors of the research. "This is decades ahead of even the most pessimistic climate models." For the last three decades, the amount of carbon absorbed by the world's intact tropical forests has fallen, according to the study from nearly 100

For the last three decades, the amount of carbon absorbed by the world's intact tropical forests has fallen, according to the study from nearly 100 scientific institutions.

scientific institutions. They are now taking up a third less carbon than they did in the 1990s, owing to the impacts of higher temperatures, droughts and deforestation. That downward trend is likely to continue, as forests come under increasing threat from climate change and exploitation. The typical tropical forest may become a carbon source by the 2060s, according to Lewis. "Humans have been lucky so far, as tropical forests are mopping up lots of our pollution, but they can't keep doing that indefinitely," he told the Guardian. "We need to curb fossil fuel emissions before the global carbon cycle starts working against us. The time for action is now." At this year's UN climate talks, known as Cop26 and to be held in Glasgow in November, many countries are expected to come forward with plans to reach net zero emissions by mid-century. But some rich countries and many companies plan to reduce their emissions via offsetting, often by preserving, replanting or growing new forest. This research shows that relying on tropical forests is unlikely to be enough to offset large-scale emissions. "There is a lot of talk about offsetting, but the reality is that every country and every sector needs to reach zero emissions, with any small amount of residual emissions needing to be removed from the atmosphere," said Lewis. "The use of forests as an offset is largely a marketing tool for companies to try to continue with business as usual." The uptake of carbon from the atmosphere by tropical forests peaked in the 1990s when about 46bn tonnes were removed from the air, equivalent to about 17% of carbon dioxide emissions from human activities. By the last decade, that amount had sunk to about 25bn tonnes, or just 6% of global emissions. The difference is about the same as a decade of fossil fuel emissions from the UK, Germany, France and Canada put together. Climate scientists have long feared the existence of "tipping points" in the climate system, which when passed will condemn the world to runaway global heating. There are many known feedback mechanisms: for instance, the melting of Arctic ice leaves more of the sea uncovered, and, as it is darker than the reflective ice, it absorbs more heat, thus leading to more melting. These feedback mechanisms have the potential to accelerate the climate crisis far ahead of what current projections suggest. If forests start to become sources of carbon rather than absorbers of it, that would be a powerful positive feedback leading to much greater warming that would be hard to stop. Forests lose their ability to absorb carbon as trees die and dry out from drought and higher temperatures, but the loss of forest area from logging, burning and other forms of exploitation is also a leading factor in the loss of carbon sinks. Tom Crowther, founder of the Crowther Lab, who was not involved with the research, told the Guardian: "This analysis provides concerning evidence that, along with continuing deforestation rates, the carbon sequestration

rate of tropical forests could also be threatened by increasing tree mortality under climate change. This is very important information, as the capacity of tropical forests to capture anthropogenic carbon emissions could be severely impaired." The study, published on Wednesday in the journal Nature, tracked 300,000 trees over 30 years, providing the first large-scale evidence of the decline in carbon uptake by the world's tropical forests. The researchers combined data from two large research networks of forest observations in Africa and the Amazon, as well as years spent travelling to remote field sites, including a week spent in a dug-out canoe to reach Salonga national park in the troubled Democratic Republic of the Congo. They used aluminium nails to tag individual trees, measuring the diameter and estimating the height of every tree within 565 patches of forest, and returning every few years to repeat the process. This enabled them to calculate the carbon stored in the trees that survived and those that died. They found that the Amazon sink started weakening first, but that African forests are now rapidly following. Amazonian forests are exposed to higher temperatures, faster temperature increases, and more frequent and severe droughts, than African forests. Their projection that the Amazonian forest will turn into a carbon source in the mid-2030s is based on their observations and a statistical model and trends in emissions, temperature and rainfall to forecast changes in how forests will store carbon up to 2040. Doug Parr, the chief scientist at Greenpeace UK, said governments should heed the science and make strong commitments to cut greenhouse gases at the Cop26 summit, and agree to measures to protect and restore forests. "For years, we have had scientific warnings about tipping points in the Earth system and they've been largely ignored by policy and decision-makers," he said. "That forests are now seemingly losing the ability to absorb pollution is alarming. What more of a wake-up call do we need?"

theguardian.com, 5 March 2020

https://www.theguardian.com=

Minimuscles let amputees control a robot hand with their minds

2020-03-04

Building a beautiful robotic hand is one thing. Getting it to do your bidding is another. For all the hand-shaped prostheses designed to bend each intricate joint on cue, there's still the problem of how to send that cue from the wearer's brain. Now, by tapping into signals from nerves in the arm, researchers have enabled amputees to precisely control a

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robotic hand just by thinking about their intended finger movements. The interface, which relies on a set of tiny muscle grafts to amplify a user's nerve signals, just passed its first test in people: It translated those signals into movements, and its accuracy stayed stable over time. "This is really quite a promising and lovely piece of work," says Gregory Clark, a neural engineer at the University of Utah who was not involved in the research. It "opens up new opportunities for better control." Most current robotic prostheses work by recording—from the surface of the skin—electrical signals from muscles left intact after an amputation. Some amputees can guide their artificial hand by contracting muscles remaining in the forearm that would have controlled their fingers. If those muscles are missing, people can learn to use less intuitive movements, such as flexing muscles in their upper arm. These setups can be finicky, however. The electrical signal changes when a person's arm sweats, swells, or slips around in the socket of the prosthesis. As a result, the devices must be recalibrated over and over, and many people decide that wearing a heavy robotic arm all day just isn't worth it, says Shriya Srinivasan, a biomedical engineer at the Massachusetts Institute of Technology. But there's another way to tap into a person's intended movements: by listening to the nerves that transmit the brain's commands down the arm. Wires planted directly into these nerves can capture electrical signals to control a prosthesis. But the signals are faint, and small movements of the fine nerve fiber relative to the recording electrode can change or obscure the nerve's subtle message. So researchers have tried to boost nerve signals by connecting them to a muscle. Some have rerouted nerves from the arm into a chest muscle and picked up the strong electrical signal as a person contracts that muscle by thinking about moving their hand. But surgeons must strip out some existing nerves in the chest to route in the new ones. As Clark puts it, "There's only one car that can fit in the parking spot." That means the procedure may compromise a muscle some amputees use to move their remaining upper arm. For about 10 years, a team led by plastic surgeon Paul Cederna at the University of Michigan (UM), Ann Arbor, has been developing an alternative approach: Give the nerves new minimuscles of their own. The researchers isolate bundles of fibers from each of the major nerves in the arm and wrap each bundle in a chunk of muscle tissue roughly the size of a paper clip, often harvested from the thigh. The process basically creates a new set of finger muscles inside a person's forearm or bicep. Because wrapping nerves this way also relieves certain types of pain common after an amputation, hundreds of people have already had the procedure—but without the wire implants that could record from the muscles to control a prosthesis. In a new study out today in *Science Translational Medicine*, Cederna and UM neural engineer Cynthia

Chestek describe the first test of that control step. In three participants with amputations at different points along the arm who already had muscle implants, wires inserted through the skin near the muscle grafts could easily pick up their electrical signals, the researchers report. Even with an amputation up near the shoulder, a computer could interpret which tiny muscles were contracting, and by how much, to isolate different intended movements—a flex of the pointer finger versus the thumb, for example. "The isolation that they get with these little muscle grafts is really quite remarkable," Clark says. Two of the participants—both with amputations at the wrist—opted for long-term electrode implants, which allowed further tests of their hand control. Using computer algorithms that "learned" to translate electrical signals into intended movements, the participants could prompt a virtual hand on a computer screen to assume any of five positions on cue. And when controlling a commercially available prosthesis called the LUKE arm, both participants could move the thumb to precise targets in space and pick up and stack a set of small wooden blocks. Because the prosthesis relies on signals from nerves naturally involved in hand movement, participants could get it to move the way they wanted it to on the first try, Chestek says; there was nothing for them to learn. And without recalibrating the system, her team found that participants maintained the same degree of control after 300 days. "There's no reason it would go away," Chestek says. "The nerve is stable and happy." The setup isn't ready for prime time. For now, wires tether participants to the lab equipment that reads and interprets the electrical signals. Chestek and Cederna eventually plan to develop a compact implant that doesn't require wires that stick out through the skin. If the device can be optimized and win regulatory approval, it might offer amputees robotic appendages that are less of a handful.

sciencemag.org, 4 March 2020

https://www.sciencemag.org=

How to save insects? Give them space

2020-03-03

Butterflies and bees, ants and beetles, cockroaches and flies — whether loved or feared, insects help humans. Just sample the ways these animals enable life as we know it: they pollinate crops, give us new medicines, break down waste and support entire ecosystems. Yet many insects around the world are in decline. Writing in the journal Biological Conservation, more than two dozen scientists from countries around the world are warning of a wave of insect extinctions — and urging swift steps

Yet many insects around the world are in decline.

to curb the crisis. In a paper sketching solutions, the scientists say that to save insects we must give them the space they need to survive in the face of climate change: livable, interconnected habitats flush with a rich diversity of plant and animal life. Ensuring that insects have room to thrive means setting aside local habitat, including parks, gardens, roadsides and the edges of farm fields. It also entails protecting continent-scale migratory passages like the corridor that monarch butterflies traverse from Minnesota to Mexico. Not just any areas will do, the researchers caution. Insects need quality space, too. The closer an area is to the condition it was in before humans altered it for the worse, the better. "We need to move the needle of novel landscapes towards one of greater ecological integrity and more complex interaction networks," Michael Samways, one of the paper's authors and an insect conservationist at South Africa's Stellenbosch University, wrote in an email to Ensia. In South Africa, a network of conservation corridors — composed mainly of native grassland — cuts through plantations of non-native pine trees. "These corridors enable insects to ebb and flow across the landscape as they would in a nature reserve," ecologist Michael Samways wrote in an email to Ensia. Space that's free from pollution and invasive species, with diverse plant life and a varied landscape, will best help insects — and that includes enough room for the six-legged critters to find food, seek mates and just rest. "Part of being able to move around is to be able to 'dodge' natural enemies, from bats and birds, to other insects like predatory ladybugs and parasitic wasps," Samways explained. Our changing climate pushes many insects to evolve, move or die — a dynamic that often puts them up against the extensive transformation humans have wrought on Earth's surface. Habitat fragmentation exacerbates the threat by limiting insects' ability to traverse the landscapes separating them from more suitable surroundings. But with quality space that's connected by conservation corridors and other adequate habitat, the researchers write, insects can leave enough healthy offspring to sustain their species. Scientists know what insects need, but scaling proven strategies up to the massive level needed to make a dent in extinctions is a different challenge entirely. "Especially when you're thinking about insects, you have to get public buy-in," says DeAnna Beasley, an ecologist at the University of Tennessee at Chattanooga who was not involved in the paper. Highlighting this key hurdle, the report authors bemoaned "the current lack of sufficient collective political will and concerted effort" to save insects. To build that will, the scientists call for greater efforts to communicate the value of insects to society. For example, Beasley has used cicadas — a kind of insect that needs "a large, contiguous space" to sustain big populations — in citizen science research, getting more data for science while building more appreciation for

insects among the public. In one project the paper spotlights, students at schools in Austria successfully assessed the quality of space for butterflies, laying the groundwork for follow-up by trained scientists. With many insects unnoticed or misunderstood, the researchers also recommend the continued use of "insect icons" and "flagship species" to promote support for conservation. "Highlighting the animals that people know best is vital for our effort to get people engaged in invertebrate or insect conservation," says Scott Hoffman Black, executive director of the Xerces Society for Invertebrate Conservation, who was not involved in the new paper. Black also underscores that charismatic insects are just a starting point. "We need people to understand the consequences of not taking action and give them solutions that they can enact in their own lives," Black says. "As well as getting them to push their governments to take action."

ensia.com, 3 March 2020

https://www.ensia.com=

AI can pick out specific odours from a combination of smells

2020-03-16

Cleland and Imam trained the AI to detect 10 different odours, including those of ammonia and carbon monoxide

An AI can sniff out certain scents, giving us a glimpse of how our nose might work in detecting them. Thomas Cleland at Cornell University, New York, and Nabil Imam at tech firm Intel created an AI based on the mammalian olfactory bulb (MOB), the area of the brain that is responsible for processing odours. The algorithm mimics a part of the MOB that distinguishes between different smells that are usually present as a mixture of compounds in the air. This area of the MOB contains two key types of neuron: mitral cells, which are activated when an odour is present but don't identify it, and granule cells that learn to become specialised and pick out chemicals in the smell. The algorithm mimics these processes, says Imam. Cleland and Imam trained the AI to detect 10 different odours, including those of ammonia and carbon monoxide. They used data from previous work that recorded the activity of chemical sensors in a wind tunnel in response to these smells. When fed that data, the AI learns to detect that a smell is present based on the sensors' responses to the chemicals, and then goes on to identify it on the basis of the patterns in that data. As it does so, the AI has a spike of activity analogous to the spikes of electrical activity in the human brain, says Imam. The AI refined its learning over five cycles of exposure, eventually showing activity spikes specific to each odour. The researchers then tested the AI's ability

to sniff out smells among others that it hadn't been trained to detect. They considered an odour successfully identified when the AI's fifth spike pattern matched or was similar to the pattern produced by the sensors. The AI got it almost 100 per cent correct for eight of the smells and about 90 per cent correct for the remaining two. To test how it might identify odorous contaminants in the environment, the researchers blocked 80 per cent of the smell signal to mimic more realistic scenarios. In these tests, the AI's accuracy dipped to less than 30 per cent. "I think the link [to the MOB] is quite strong – this algorithm might be an explanation to how it works in the human nose, to some abstraction," says Thomas Nowotny at the University of Sussex, UK. But the AI's ability to solve real life problems, such as detecting bombs by picking out hazardous smells associated with them, is still some way off, he says.

newscientist.com, 16 March 2020

https://www.newscientist.com=

All the reasons why organic food doesn't deserve such bad press

2020-03-16

People are keener than ever to make ethical, environmentally friendly food purchases. But a spate of bad press about the environmental impact of organic produce may leave some people scratching their heads.
The debate about this is contentious. Critics say organic farming is less efficient than conventional farming, and so uses more land, leading to greater deforestation, which causes higher carbon dioxide emissions and biodiversity loss. A recent paper followed this logic to find that going 100 per cent organic in England and Wales would raise these emissions by up to 56 per cent. The claim made headlines. But the findings from this study and similar ones are too simplistic and ignore important positive aspects of organic farming. We have analysed such studies and found that the method they often use doesn't give the full picture. Known as a life cycle assessment (LCA), this approach simply relates environmental impacts to the amount of product harvested from a given area of land. Looked at this way, intensive farming is often more efficient, since its yields are higher. But this doesn't properly address all environmental aspects. Such assessments fail to fully account for the role of land degradation, biodiversity decline and pesticide impacts of intensive agriculture. Consider biodiversity, for example. The variety of life on Earth is an incredibly important factor in the health and resilience of ecosystems. But worldwide, it is in decline – insect and bird populations are being

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decimated, something that has been repeatedly linked to the damaging practices of intensive farming. Organically managed land, however, has been shown to support biodiversity levels around 30 per cent higher than conventionally farmed fields. It might be argued that the land saved through conventional farming could be reserved for biodiversity and CO_2 absorption. But the relationship between agricultural intensification and reduced deforestation is unclear. In Brazil, for example, agricultural intensification has coincided with more deforestation. Widespread use of pesticides is also a concern – between 1990 and 2015, global pesticide use has increased more than 70 per cent. Pesticide residues can be harmful to land and aquatic ecosystems, as well as our health. The avoidance of synthetic pesticides in organic farming, and the overall much lower levels of pesticide use in general, is a factor that is often overlooked in LCAs. In the 34 studies comparing organic with conventional agriculture that we reviewed, only nine looked at pesticide-related impacts. The debate around the environmental impact of organic farming has become too simplistic and narrow. Our review, published in Nature Sustainability, shows that organic farming's strengths and environmental benefits are often overlooked by the current research, and simply claiming that organic farming is worse for the environment is misleading. The current use of LCAs needs to be improved and integrated with other environmental assessment tools. Only then will consumers get a more balanced picture.

newscientist.com, 16 March 2020

https://www.newscientist.com=

CHEMWATCH

Bulletin Board

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MAR. 27, 2020

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Perspectives of genetically engineered microbes for groundwater bioremediation

Prospects of integrating algae technologies into landfill leachate treatment. 2020 Feb 25. doi: 10.1039/c9em00601j. [Epub ahead of print]

Suspect and non-target screening of pesticides and pharmaceuticals transformation products in wastewater using QTOF-MS

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