CHEMWATCH

Bulletin Board

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NOV. 26, 2021

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ASIA PACIFIC

Australian branded food database

2021-11-10

We're developing a database of the nutrient content of branded foods and beverages sold in Australia.

The database will provide a central source of brand specific information including nutrient content to help people make informed decisions about the foods and beverages they buy. It will also help inform our standards development work and public health and nutrition initiatives such as the Healthy Food Partnership Reformulation Program and the Health Star Rating System.

Over time, the database could link with other datasets to provide a more comprehensive picture of food and nutrient consumption patterns in the Australian population.

Data collection

We have partnered with GS1 Australia to work directly with food manufacturers and retailers to collect branded food data. Working collaboratively with industry will help ensure the database captures a wide range of foods and product information, including season-specific products.

The goal is to have information on 85 per cent of all packaged food and beverage products available on the shelves of national retailers in the database by 2023.

Data collected will include a range of on-pack information including Global Trade Item Number (GTIN), manufacturer, brand and food name, nutrition information panel, listed ingredients, pack and serve size and health star rating (HSR), if displayed. Where relevant, we will also collect off-pack information relating to HSR including HSR category and a product's dietary fibre and fruit, vegetable, nut and legume (FVNL) content.

Existing GS1 Australia registered members can provide data to FSANZ via the National Product Catalogue (NPC) from January 2022, while all other manufacturers and retailers will be able to submit data via a FSANZ online portal, expected to be operational by mid-2022.

Over time, the database could link with other datasets to provide a more comprehensive picture of food and nutrient consumption patterns in the Australian population.

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Targeted data collection may be undertaken where initial data coverage is low, or to fill gaps identified in the dataset.

Other data collection methods may be considered with time.

Accuracy of data collected

All data provided to us will be checked against pre-defined rules as part of the data collection and exchange process with GS1 Australia. Data cannot be incorporated into the branded food database until these rules have been met.

Targeted in-store audits also will be undertaken to ensure the accuracy and currency of the data collected.

It is important to note that the data we collect as part of the work is to inform public health initiatives and not for compliance or enforcement purposes.

Read More

Food Standards Australia New Zealand, 12 November 2021

https://www.foodstandards.gov.au/science/monitoringnutrients/Pages/Branded-food-database.aspx

China consults on new GB standard for food contact paints and coatings (BG 4806.10)

2021-11-17

On Nov. 17, 2021, Beijing Product Quality Supervision and Inspection Institute issued a notice to solicit public opinions for "GB 4806.10-xxx Paints and Coatings in Contact with Foodstuffs (Draft)". Any comment can be submitted via email weilikun001@126.com before Dec. 12, 2021.

Major Revisions Revealed by the Draft

Application Scope

This revision proposes to include all the paints and resins for coatings from the current GB 4806.10-2016 and all notifications issued by National Health Commission (NHC) from 2016-2021, like the latest NHC Notice No. 9 of 2021. Therefore, the application scope was extended correspondingly. Compared with the current version, paints and coatings for paper are newly included in the application scope.

Physicochemical Indicators for Coatings

Any comment can be submitted via emailweilikun001@126.com before Dec. 12, 2021.

The draft further improves the physicochemical indicators. For epoxy coatings with different disphenol epoxy derivatives, the corresponding three indictors are set. If the epoxy coating contains BADGE, the overall migration shall not more than 9 mg/kg or 9 mg/6dm^2. If it contains BADGE·HCl, then the overall migration shall not more than 1 mg/kg or 1 mg/6dm^2. If it contains BFDGE or NOGE, then the coating is forbidden for using.

Labeling Requirements

According to the current version, the labeling of coatings and articles shall conform to GB 4806.1. Now the draft further specifies that coating materials and articles shall also be marked with the substance names of the substrate and coating following an order from the outer layer to the layer in direct contact with food.

Use Requirements of Basic Raw Materials for Paints and Coatings

Same as the current version, the Annex A of the draft provides a list for basic raw materials allowed to be used in paints and coatings in contact with foodstuffs and relevant use requirements. In addition, the draft clarifies that substances with molecular weight greater than 1,000 Da formed by polymerization or other means from monomers, other initiators, basic polymers and other raw materials in this list are also allowed to be used as basic raw materials for paints and coatings for food contact.

Read More

Chemlinked, 17 November 2021

https://food.chemlinked.com/news/food-news/china-consults-on-new-gb-standard-for-food-contact-paints-and-coatings-gb-480610

South Korea to designate prohibited ingredients of online purchased overseas food

2021-11-17

On November 11, 2021, the Ministry of Food and Drug Safety (MFDS) published the Guideline on Designating and Canceling the Prohibited Ingredients of Directly Purchased Overseas Food Products[1]. This guideline is designed to help the Customs manage **overseas food purchased directly by consumers** to reduce the food risk exposed to Korean citizens.

This guideline is designed to help the Customs manage overseas food purchased directly by consumers to reduce the food risk exposed to Korean citizens.

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As per the guideline, MFDS will collect the food ingredient risk information from the foreign countries' official websites and consumer complaint. The authority will then review whether the food ingredient is a hazard ingredient and establish a profile for each ingredient. Finally, MFDS will designate and notify the **prohibited ingredients**. Overseas food with such ingredients are forbidden from entering South Korea.

MFDS also plans to conduct a re-evaluation on the prohibited ingredient termly. If the ingredient is deemed as appropriate, the banning of food containing thus ingredient will be canceled.

Read More

Chemlinked, 17 November 2021

https://food.chemlinked.com/news/food-news/south-korea-to-designate-prohibited-ingredients-of-online-purchased-overseas-food

AMERICA

First-of-its-kind certification eliminates harmful PFAS in foodware and shifts market to preferred alternatives

2021-11-02

Today, nonprofit organizations Center for Environmental Health (CEH) and Clean Production Action (CPA) unveiled the GreenScreen Certified™ Standard for Food Service Ware. The groundbreaking certification program sets a new safety standard for everyday items like disposable plates and bowls that do not contain per- and polyfluoroalkyl substances (PFAS) plus thousands of other chemicals of concern. PFAS are known as "forever chemicals" because they take thousands of years to break down in the environment and can cause cancer, thyroid disease, birth defects, hormone disruption, decreased fertility, and other serious health issues.

The certification draws from CEH's extensive work testing single-use food ware for PFAS and builds on CPA's GreenScreen® for Safer Chemicals, the globally recognized tool for chemical hazard assessment used by governments, companies, and certification standards to encourage the design and use of inherently safer chemical ingredients.

The groundbreaking certification program sets a new safety standard for everyday items like disposable plates and bowls that do not contain per- and polyfluoroalkyl substances (PFAS) plus thousands of other chemicals of concern.

For decades, PFAS have been added to microwave popcorn bags, pizza boxes, fast food wrappers, plates, bowls, food trays, take-out containers and other food packaging to make them water and grease resistant. This creates a problem in manufacturing, at the disposal stage and during consumer use. Products and packaging containing PFAS pose unnecessarily harmful threats to human health, especially as safer alternatives are already on the market and will become increasingly available. GreenScreen Certified for Food Service Ware empowers manufacturers to communicate their use of safer chemicals to buyers and position themselves as market leaders in safer chemistries and innovation.

Eco-Products is the first manufacturer to earn the GreenScreen Silver designation for a food service ware product line. **NatureWorks** is the first material company to achieve the GreenScreen Certified Standard Platinum level of certification.

Read More

Greenscreen Chemicals, 2 November 2021

https://www.greenscreenchemicals.org/resources/entry/greenscreen-certified-food-service-ware

EPA denies TSCA Section 21 petition regarding chemical mixtures in cigarettes

2021-11-08

On October 29, 2021, the U.S. Environmental Protection Agency (EPA) announced its response to a petition submitted under Section 21 of the Toxic Substances Control Act (TSCA) seeking a rule requiring cigarette manufacturers to eliminate the hazardous chemicals used and to develop new product designs that eliminate or reduce the cigarette butt disposal risks to the environment. 86 Fed. Reg. 59931. EPA states that TSCA Section 6(a) authorizes it to determine if a chemical substance or mixture in manufacturing, processing, distribution in commerce, use, disposal, or any combination of these activities presents an unreasonable risk of injury to health or the environment. If EPA determines that there is unreasonable risk to health or the environment, then EPA must, by rule, issue regulations to the extent necessary so that the chemical substance no longer presents

EPA notes that TSCA Section 3(2)(B), which defines "chemical substance," excludes "tobacco or any tobacco product," however

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such risk. EPA notes that TSCA Section 3(2)(B), which defines "chemical substance," excludes "tobacco or any tobacco product," however. Under Section 201(rr) of the Federal Food, Drug, and Cosmetic Act (FFDCA), "tobacco product" means "any product made or derived from tobacco that is intended for human consumption, including any component, part, or accessory of a tobacco product." EPA states that it finds that the petitioner has not met its burden as defined in TSCA Sections 6(a) and 21(b)(1) "because cigarettes are not a product that can be regulated under TSCA section 6(a)."

Read More

TSCA, 8 November 2021

http://www.tscablog.com/entry/epa-denies-tsca-section-21-petition-regarding-chemical-mixtures-in-cigarett

EPA, lawmakers inch toward limit on toxic chemical leaching into drinking water

2021-11-18

How the federal government plans to do more to keep potentially deadly chemicals from slipping through regulatory cracks.

The infrastructure bill signed by President Joe Biden earlier this week contains billions of dollars to cleanup a dangerous chemical in drinking water across this country. But, the federal government's struggle with how to prevent forever chemical contamination in the first place isn't over just yet.

There's been a slow drip of regulation over the last twenty years, as the EPA tries to contain a class of deadly chemicals linked to cancer. Health studies find 95% of Americans have PFAS in their bloodstream, but there's no national, enforceable standard for what level of exposure can be considered safe.

The slow pace of progress frustrates lawmakers like Sen. Shelley Moore Capito (R-W.Va.).

"I want a level we can use as a standard nationally," she said in a recent interview, "And we can be sure that our children and grandchildren are

Health studies find 95% of Americans have PFAS in their bloodstream, but there's no national, enforceable standard for what level of exposure can be considered safe.

not going to be having any ill effects from drinking [from] their own water systems."

The Biden administration promises just that, outlining steps leading to a better flow of resources for cleanup and forcing polluters to cover the bill.

Contamination is largely the byproduct of Teflon manufacturing and a foam used to fight jet fuel fires but the chemical can even be found in food packaging at low levels. Under the government's timeline, a true legal limit is still years away, set to arrive around fall 2023.

"Believe it or not, that's pretty much light-speed for this regulation," said Gina McCarthy, the White House National Climate Advisor and former administrator of the EPA.

McCarthy said there's strong health science surrounding PFOS and PFOA but not for hundreds of chemical cousins in the PFAS family.

Read More

Vcax, 18 November 2021

https://www.wcax.com/2021/11/17/epa-lawmakers-inch-toward-limit-toxic-chemical-leaching-into-drinking-water/

No treats, too many tricks, for PFAS this Halloween

2021-11-17

In a major move by California that may be but a harbinger of a dramatic sea change in banning or severely restricting the inclusion of hundreds of chemicals present in every-day consumer goods, California just imposed upon the consumer product industry (culminating, at least most likely for 2021, right before the end of October), a sweeping range of bans that likely will fundamentally disrupt the California consumer product economy.

Ostensibly driven by concern over the presence of PFAS and other chemicals loosely included in that family of compounds colloquially referred to as "forever chemicals," and even in the absence of developed or well-understood science assessing the potential for human health risk, Governor Newson signed four bills in just one day in October that

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established new laws affecting food packaging, cookware and children's mattresses, sets, strollers and the like, on the heels of the enactment of additional legislation and regulation passed earlier this year and last that has progressively been expanding both the scope and the magnitude of these impending bans and restrictions on the sale of consumer and commercial products containing PFAS in California.

There is no real question that the science surrounding PFAS, for example, is in its infancy – as observed even by the Agency for Toxic Substances and Disease Registry (ATSDR):

"Scientists are still learning about the health effects of exposures to mixtures of PFAS … more research will help scientists fully understand how PFAS affect human health."

By contrast, at the federal level, the USEPA has chiefly dedicated its efforts to addressing the presence of PFAS and other so-called "legacy chemicals" within underground drinking water supplies, a core mandate with which the USEPA is charged by Congress, underscoring the impactful, yet potentially premature and disruptive nature of the recent California action, as it is aimed not at groundwater remediation but rather at a broad swath of manufacturing, commercial, and retail enterprises that likely do not know – and, moreover, likely cannot feasibly ascertain, whether their products are even subject to the new laws.

In a pronouncement by USEPA Administrator Michael Reagan that accompanied the much-heralded release on October 18 of the USEPA's "PFAS Roadmap," Administrator Reagan explained that the USEPA is "laser focused" on developing a "comprehensive, national PFAS strategy," but not a reckless one. In fact, a cornerstone of the PFAS Roadmap is a multi-year strategy deploying a measured approach to refining the necessary scientific research while incorporating appropriate policies involving stakeholders affected by the PFAS Roadmap. Some insiders believe that the complexity of this task will take several years, at least, to be developed.

Not so in California.

Read More

Retail Consumer Products Law, 17 November 2021

https://www.retailconsumerproductslaw.com/2021/11/no-treats-too-many-tricks-for-pfas-this-halloween/

"Scientists are still learning about the health effects of exposures to mixtures of PFAS … more research will help scientists fully understand how PFAS affect human health."

Two 'forever chemicals' more toxic than previously thought: EPA drafts

2021-11-16

New draft reports from the Environmental Protection Agency (EPA) have found that two "forever chemicals" are more toxic than previously thought, and that one is likely carcinogenic to humans.

The drafts found the safe levels of ingestion for chemicals perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) are much lower than the agency had found in prior assessments.

The agency also found that PFOA is "likely" carcinogenic to humans. This is a step up from before, as it has previously said that there is "suggestive" evidence that the substance can cause cancer.

Both PFOA and PFOS can be found in drinking water, as well as other substances. PFOA has been used in nonstick cookware, flame repellants and cosmetics. PFOS has been used in water- and stain-resistant products.

The latest findings come as part of an EPA effort to regulate the substances, with the agency saying that it will aim to finish drinking water limits for PFOA and PFOS in 2023.

Scott Faber, senior vice president for government affairs at the Environmental Working Group, told The Hill that the stronger toxicity finding is a sign that the agency will issue strong regulations.

"There's no turning back. The evidence is now overwhelming, that PFAS is toxic at very low levels and that tens of millions if not hundreds of millions of Americans have unsafe levels of PFOA in particular in their drinking water," Faber said.

Read More

The Hill, 16 November 2021

https://thehill.com/policy/energy-environment/581864-two-forever-chemicals-more-toxic-than-previously-thought-epa-drafts

The agency also found that PFOA is "likely" carcinogenic to humans.

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EUROPE

BG biocides regulations: HSE invites backers for more than 90 substance uses

2021-11-16

The UK's Health and Safety Executive (HSE) is inviting companies to take over the role of participant for more than 90 active substances/product-type combinations that have not been resubmitted under the GB biocidal active substance review programme.

The open invitations, published in this week's *Biocides Bulletin* alert, are for substances that include:

- seven types of active bromine;
- three types of active chlorine;
- hydrogen peroxide;
- alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC);
- alkyl (C12-18) dimethylbenzyl ammonium chloride (ADBAC);
- alkyl (C12-C14) dimethyl(ethylbenzyl)ammonium chloride (ADEBAC);
- alkyl (C12-C14) dimethylbenzylammonium chloride (ADBAC); and
- didecyldimethylammonium chloride (C8-10) (DDAC).

The substances are being evaluated as part of the EU's biocides review programme and the deadlines for resubmitting applications under the GB regime were 31 March or 29 June.

Any person, company or task force/consortium that intends to support one of the active substances or product-type combinations in the HSE's list must notify the executive by 12 November 2022.

If no one takes over as participant, the substances will not be approved under the GB biocidal products Regulation (BPR), and biocidal products containing them will have to be removed from the market.

In April, the HSE was looking for companies to back five other active substances under the GB's review programme.

Read More

Chemical Watch, 16 November 2021

https://chemicalwatch.com/372768/gb-biocides-regulation-hse-invites-backers-for-more-than-90-substance-uses

The UK's Health and Safety Executive (HSE) is inviting companies to take over the role of participant for more than 90 active substances/product-type combinations that have not been resubmitted under the GB biocidal active substance review programme.

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EU Commission proposes sweeping changes to waste export regulations

2021-11-18

The EU Commission has proposed new legislation on the export of waste, to overhaul current restrictions and introduce new digital reporting obligations on both intra- and extra-EU waste shipments, along with new auditing responsibilities.

The changes could also restrict the import and export of waste for chemical recycling due to the ongoing uncertainty around its legal definition.

The Commission is proposing an EU-wide system to electronically exchange documents and information, which would allow authorities to better monitor waste streams.

Materials not listed on the EU's green list and destined for recovery operations will require prior written consent and approval from relevant authorities in both the sending and receiving countries.

Materials on the green list include:

- Wastes listed in annex IX of the Basel Convention (commonly known as the OECD green list)
- EU3011 classified waste, but only for shipments destined for recycling within the EU, this includes waste bales largely free from contamination and almost exclusively consisting of:
- polyethylene (PE)
- polypropylene (PP)
- polyethylene terephthalate (PET)
- polystyrene (PS)
- non-hazardous waste mixtures of PE, PP and PET as long as they are free from almost all contaminants and other wastes, and will be separately recycled
- polycarbonate (PC)
- acrylonitrile butadiene styrene (ABS)
- polyethers
- polyvinyl chloride (PVC)
- polyvinylidene fluoride (PVDF)
- urea formaldehyde resins

The changes could also restrict the import and export of waste for chemical recycling due to the ongoing uncertainty around its legal definition.

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- phenol formaldehyde resins
- melamine formaldehyde resins
- epoxy resins
- alkyd resins
- perfluoroethylene/propylene (FEP)
- perfluoroalkoxy alkanes (PFA)
- tetrafluoroethylene/perfluoroalkyl vinyl ether
- Tetrafluoroethylene/perfluoromethyl vinyl ether (MFA)
- polyvinylfluoride (PVF)
- polytetrafluoroethylene (PTFE)
- Clean biodegradable waste from agriculture, horticulture, forestry, gardens, parks and cemeteries

The proposals would use the definition of recycling set out in Directive 2008/98/EC, in which recycling is "any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations."

This leaves the regulatory status of chemical recycling under the proposals uncertain.

In Europe, pyrolysis is the most common form of chemical recycling. Pyrolysis typically converts mixed plastic waste into pyrolysis oil, which is a naphtha substitute.

Although there are several different potential input waste sources, pyrolysis-based chemical, 70% mixed-polyolefin, 90% mixed-polyolefin, or refuse derived fuel (RDF) reject bales (which contain a maximum 0.5% PVC content) are commonly used, depending on what sorting facilities chemical recyclers have on site.

Proposals under this legislation could potentially limit the intra-EU shipment of mixed-polyolefin waste for chemical recyclers.

The EU previously indicated that it would take a decision on chemical recycling's legal status in 2021, which will be contingent on a cradle-to-grave LCA (Life Cycle Analysis), although an announcement this year is looking increasingly unlikely.

Read More

ICIS, 18 November 2021

https://www.icis.com/explore/resources/news/2021/11/18/10707381/eu-commission-proposes-sweeping-changes-to-waste-export-regulations

INTERNATIONAL

Phthalates' regulatory standards may not protect people's health, new study

2021-11-17

Researchers found health impacts at exposure levels that are 8,000 times lower than some regulatory limits.

"Safe" limits on human exposure to phthalates set by national and international regulatory authorities may not adequately protect public health, according to a new analysis published in the journal Environmental Health on Monday.

The study, synthesizing dozens of human studies, drew significant associations between phthalate exposure and human reproductive, neurodevelopmental, behavioral, hormonal, and metabolic health problems. It also underpins the need for reassessing regulatory standards with up-to-date science.

It also underpins the need for reassessing regulatory standards with up-to-date science.

A group of chemicals widely used in the plastic industry to soften plastic products, phthalates are omnipresent in modern life. From rubber duckies to garden hoses to fast food burgers, phthalates can easily sneak into our bodies and disrupt our endocrine system by heisting hormone receptors—such as the estrogen receptors or the retinoic acid X receptors—and messing with gene expression switches. Human and animal studies have linked phthalates to a wide range of health impacts, including birth and reproduction problems, impaired brain development, diabetes, and cancer.

"We know that the exposure [to phthalates] is quite broad," Maricel Maffini, an independent public health consultant based in the U.S. and the lead author of the paper, told EHN. "We were trying to figure out whether the

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doses that regulators considered safe for people to be exposed to are still protective." The study was funded by Swiss conservation nonprofit, MAVA Foundation, and Food Packaging Forum, a Zurich-based science communication nonprofit focused on food packaging materials and their impacts on health.

Worst-offender phthalates

This paper focused on five what Maffini called "worst-offender" phthalates: benzyl butyl phthalate (BBP), diisobutyl phthalate (DIBP), dibutyl phthalate (DBP), dicyclohexyl phthalate (DCHP), and bis(2-ethylhexyl) phthalate (DEHP).

To investigate the health impacts, the authors extracted data from 38 previously published papers where any of the five chemicals or their metabolites were shown to have a statistically significant association with a health outcome. They then extrapolated the level for each phthalate linked to the adverse health effects and compared them with phthalates' safe limits set by the European Chemicals Agency, which proposes phthalate regulations to the European Commission, and the U.S. Consumer Protection Safety Commission, whose phthalate ban in the U.S. has only been limited to children's toy or child care articles.

Read More

Environmental Health News, 17 November 2021

https://www.ehn.org/phthalates-health-effects-2655750264.html

ISO publishes standard on evaluating the antimicrobial performance of textiles containing manufactured nanomaterials

2021-11-17

The International Organization for Standardization (ISO) recently published ISO/TS 23650:2021, "Nanotechnologies — Evaluation of the antimicrobial performance of textiles containing manufactured nanomaterials." ISO states that the standard specifies the antimicrobial performance assessment method for textiles containing manufactured (metals/metal oxides) nanomaterials. The textiles in the standard include fabric, yarn, and fiber in which manufactured nanomaterials are used during the production or finishing process. The standard also specifies protocols to determine the quantity of nanomaterials released from the textiles following washing and/or exposure to artificial human body sweat.

ISO states that the standard specifies the antimicrobial performance assessment method for textiles containing manufactured (metals/metal oxides) nanomaterials.

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ISO notes that the standard covers only the antibacterial, antifungal, and anti-odor performance assessment method of textiles containing manufactured nanomaterials. The standard does not cover textiles that have therapeutic applications or the environmental, health, and safety (EHS) issues related to textiles containing manufactured nanomaterials. ISO states that the standard does not cover the release of nanomaterials as a result of aging, dry attrition, and abrasion, "although it is considered as an effective factor in releasing nanomaterials."

Nano and Other Emerging Chemical Technologies Blog, 17 November 2021

https://nanotech.lawbc.com/2021/11/iso-publishes-standard-on-evaluating-the-antimicrobial-performance-of-textiles-containing-manufactured-nanomaterials/

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HSE has updated its guidance on dichloromethane

2021-11-18

The new guidance will help those working with Dichloromethane (DCM) in paint stripping to comply with their duties under the Control of Substances Hazardous to Health Regulations 2002 (as amended) to control exposure to hazardous substances and protect workers' health.

There is advice for managers and a direct advice sheet for stripping surface coatings from alloy wheels.

For further information visit the website.

HSE, 18 November 2021

https://www.hse.gov.uk/coshh/essentials/direct-advice/dichloromethane.htm

ECHA current calls for comments and evidence

2021-11-18

Calls for comments and evidence allow interested parties to signal their interest and express their views and concerns in the preparatory phase of the restriction proposal. They also let interested parties comment on the different documents under preparation in ECHA in relation to restrictions, such as reports on substances in articles and guidelines on restriction entries.

Additional information to justify or support comments made is also welcomed. The information gathered will provide an input into developing Annex XV restriction dossiers or other documents. When we open a call for comments and evidence, we intend to give parties who otherwise might not have been identified and consulted a chance to submit information.

The calls for comments and evidence do not take the place of the public consultation on restriction proposals developed by Member States or ECHA, which forms a standard part of the restriction process.

There is advice for managers and a direct advice sheet for stripping surface coatings from alloy wheels.

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ECHA, 18 November 2021

https://echa.europa.eu/calls-for-comments-and-evidence

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Janet's Corner

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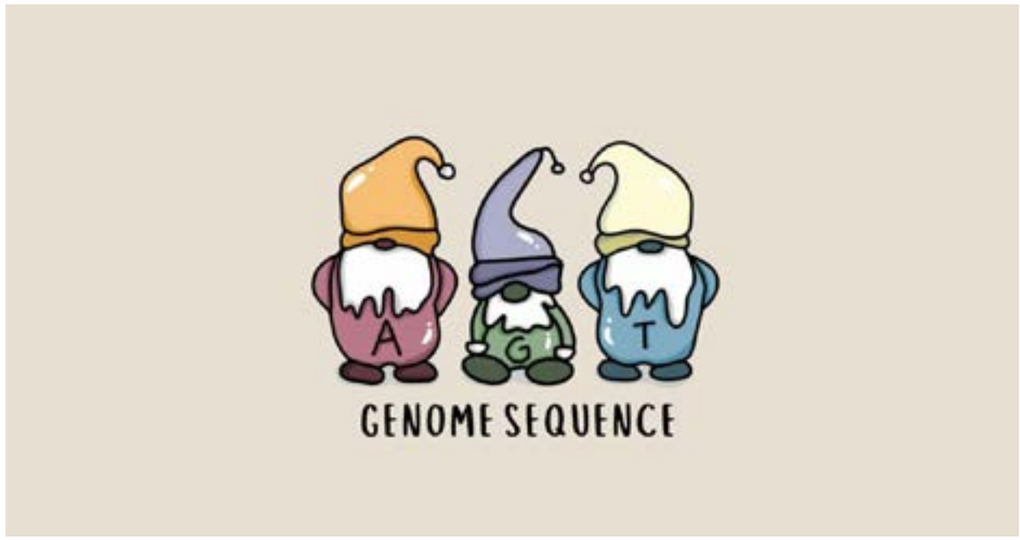
G(e)nome

2021-11-26



https://www.calpaclab.com/science-jokes/

Ethylene Glycol

2021-11-26

Ethylene glycol, chemical formula $C_2H_6O_2$, is a colourless, odourless, syrupy liquid that has a sweet taste. It can exist in the air in vapour form. Other common names for ethylene glycol are glycol and glycol alcohol. [1]

USES [1]

Ethylene glycol is used to make antifreeze and de-icing solutions for cars, airplanes, airport runways, and boats. It is used in cooling and heating systems, hydraulic brake fluids, electrolytic condensers, plasticisers, polyethylene terephthalate (PET) bottles, lacquers, resins, wood stains, leather dyeing, photographic developing solutions, textile processing, polyester fibres, synthetic waxes, cosmetics, pharmaceutical products, and safety explosives. It is used to create artificial smoke and mist for theatrical productions, and as an ingredient in several processes related to packing, transporting, or holding food. Other uses for ethylene glycol are as a solvent for paints and plastics, a softening agent for cellophane, a stabiliser for soybean extinguishing foam, and an ingredient in printers' inks, stamp pad inks, and ballpoint pen inks.

SOURCES AND ROUTES OF EXPOSURE [2,3]

Dermal or inhalation exposure to workers may occur during the manufacture or use of the chemical. Ethylene glycol may be discharged into wastewater from its production and use. It may also enter the environment from its uses in deicing airplane runways and from spills and improper disposal of used antifreeze, coolant, and solvents containing ethylene glycol. The major route of exposure for workers applying ethylene glycol products is inhalation. Other major routes include oral exposure and dermal contact with the skin and eyes. Intentional or accidental ingestion of antifreeze has resulted in thousands of poisonings each year.

TOXOKINETICS [3]

- Ethylene glycol is quickly and extensively absorbed through the gastrointestinal tract. It is slowly absorbed through the skin. Limited information suggests that it is absorbed across the respiratory tract.
- Absorbed ethylene glycol is widely distributed throughout the body.

Ethylene glycol, chemical formula C2H6O2, is a colourless, odourless, syrupy liquid that has a sweet taste.

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- It is metabolised in a series of steps that ultimately yield formate, glycine, malate, carbon dioxide and oxalic acid.
- Elimination of ethylene glycol occurs via exhaled carbon dioxide and urinary excretion of ethylene glycol, glycolic acid, and oxalic acid. The half-life for elimination is 2.5–8.4 hours.
- Ethylene glycol metabolism is saturated at higher oral doses leading to a shift in excretory pattern with a greater urinary excretion and decreased elimination via expired air.

HEALTH RISKS [2]

Acute Effects

Acute exposure of humans to ethylene glycol by ingesting large quantities causes three stages of health effects. CNS depression, including such symptoms as vomiting, drowsiness, coma, respiratory failure, convulsions, metabolic changes, and gastrointestinal upset are followed by cardiopulmonary effects and later renal damage. Acute animal tests in rats, mice, rabbits, and guinea pigs have demonstrated ethylene glycol to have moderate acute toxicity by inhalation or dermal exposure and low to moderate acute toxicity by ingestion.

Chronic Effects

The only effects were noted in a study of individuals exposed to low levels of ethylene glycol by inhalation for about a month were throat and upper respiratory tract irritation. Rats chronically exposed to ethylene glycol in their diet, exhibited signs of kidney toxicity and liver effects. Ocular irritation and lesions and pulmonary inflammation have been observed in rats, rabbits, and guinea pigs subchronically exposed by inhalation. EPA has not established a Reference Concentration (RfC) for ethylene glycol. The Reference Dose (RfD) for ethylene glycol is 2.0 milligrams per kilogram body weight per day (mg/kg/d) based on kidney toxicity in rats.

Reproductive/Developmental Effects

No information is available on the reproductive or developmental effects of ethylene glycol in humans. Several studies of rodents exposed orally or by inhalation showed ethylene glycol to affect animal foetuses. Fetotoxicity manifested as increased preimplantation loss, delayed ossification, and an increased incidence of foetal malformations were reported. The inhalation study, however, noted continuous grooming of the fur, resulting in a high rate of exposure by ingestion as well.

Cancer Risk

An epidemiologic study on renal cancer mortality did not find an increased risk for workers exposed to ethylene glycol. A study by the NTP did not find an increased incidence of tumours in mice exposed to ethylene glycol in the diet. EPA has not classified ethylene glycol for carcinogenicity.

SAFETY [4]

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention if irritation occurs.
- Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.
- Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
- Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.
- Serious Ingestion: Medical Conditions Aggravated by Exposure: Persons with pre-existing kidney, respiratory, eye, or neurological problems might be more sensitive to Ethylene Glycol.

Notes to Physician:

1. Support vital functions, correct for dehydration and shock, and manage fluid balance.
2. The currently recommended medical management of Ethylene Glycol poisoning includes elimination of Ethylene Glycol and metabolites. Elimination of Ethylene Glycol may be achieved by the following methods:

- Emptying the stomach by gastric lavage. It is useful if initiated within < 1 of ingestion.

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- Correct metabolic acidosis with intravenous administration of sodium bicarbonate, adjusting the administration rate according to repeated and frequent measurement of acid/base status.
- Administer ethanol (orally or by IV (intravenously)) or fomepizole (4-methylpyrazole or Antizol)) therapy by IV as an antidote to inhibit the formation of toxic metabolites.
- If patients are diagnosed and treated early in the course with the above methods, hemodialysis may be avoided if fomepizole or ethanol therapy is effective and has corrected the metabolic acidosis, and no renal failure is present. However, once severe acidosis and renal failure occur, hemodialysis is necessary. It is effective in removing Ethylene Glycol and toxic metabolites, and correcting metabolic acidosis.

Exposure Controls and Personal Protection

Exposure Control

- Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value.
- Ensure that eyewash stations and safety showers are proximal to the workstation location.

Personal Protective Equipment

The personal protective equipment recommended for handling ethylene glycol includes: safety glasses, synthetic apron and gloves (impervious). For most conditions, no respiratory protection should be required. However, if material is heated or sprayed and if atmospheric levels exceed exposure guidelines, an approved vapour (air purifying) respirator should be used.

For large spills the following personal protective equipment is recommended: splash goggles, full suit, boots and gloves. Please note that a specialist should be consulted prior to handling this product as suggested protective clothing might not be sufficient.

REGULATION [4]

Exposure Limits

United States:

- TWA: 100 (mg/m3) from ACGIH (TLV)
- CEIL: 125 (mg/m3) from OSHA (PEL)

- CEIL: 50 (ppm) from OSHA (PEL)

Australia:

- STEL: 120 (mg/m3)

United Kingdom:

- TWA: 52 STEL: 104 (mg/m3)
- Inhalation TWA: 10 (mg/m3)

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Christmas tree supplies are tight, and climate change is to blame

2021-11-23

It's Thanksgiving week, which means people are starting to go out and buy Christmas trees to put up.

But — as with so many things this year — those trees are likely to be more expensive.

In late June, when that heat dome descended on the Pacific Northwest, the temperature hit 115 degrees Fahrenheit at Chal Landgren's Christmas tree farm in northern Oregon. For three days in a row.

"Our little farm was in one of the hottest areas in the state, and we lost most of our 7- to 8-foot noble firs," Landgren said, who also works as a Christmas tree specialist at the Oregon State University Extension.

Noble firs are some of the most popular Christmas trees. Landgren would have been selling the ones he lost right about now.

The extreme heat damaged about 10% of the mature Christmas trees in the Pacific Northwest this summer, according to Doug Hundley, a seasonal spokesperson at the National Christmas Tree Association.

"So that is probably something in the tune of half a million trees that we wish were on the market this year that aren't. But when you have a 25 to 30 million tree supply, half a million is not that big a deal," Hundley said.

Another reason supply is tight, he said, is that Christmas trees take 7 to 10 years to grow. A decade ago, during the Great Recession, a lot of growers ended up with too many trees they couldn't sell. So, they pulled back.

"People weren't replanting trees as fast as they now wish they had, so we've just got a limited supply," Hundley said.

Still, anyone who wants a tree should be able to get one, he said. But it will cost 5% or 10% more than it did last year.

"Here's the real predicament: It's not an inventory issue this year, it's a global warming story long-term," said Tom Norby, president of the Oregon Christmas Tree Growers Association and owner of Trout Creek Tree Farm in Corbett, Oregon.

Another reason supply is tight, he said, is that Christmas trees take 7 to 10 years to grow.

The trees that were hit hardest by this summer's extreme heat were seedlings — about 70% of them died. "It was really bad. You can drive by fields and fields of burned-up seedlings."

It's one thing, Norby said, if that happens for one year. Growers can find ways to make up for lost trees. But if climate change makes that kind of extreme heat more common "and we have another heat dome that hits seedlings right in their peak growing cycle," then there will be serious Christmas tree shortages.

marketplace.org, 23 November 2021

https://www.marketplace.org

New anti-tick vaccine prevented Lyme disease (in guinea pigs)

2021-11-18

A new vaccine prevented guinea pigs from catching Lyme disease from infected ticks in a recent study. Whether it works in humans remains to be seen.

Black-legged ticks (Ixodes scapularis) transmit the bacterium Borrelia burgdorferi, which causes Lyme disease, to about 40,000 people in the U.S. each year, but those are only the cases we know about. The Centers for Disease Control and Prevention (CDC) estimates that the true number of annual cases may be eight- to 10-fold higher than reported, according to a Morbidity and Mortality Weekly Report published in 2018. And with black-legged ticks now expanding into new territory, the pests may soon carry Lyme disease to regions where it wasn't previously a problem, Live Science previously reported.

Now, scientists have developed a tool to prevent the spread of Lyme disease: A vaccine that stops ticks from feeding properly once they latch onto a host's skin, which stops the pests from transmitting B. burgdorferi. In guinea pigs, the new vaccine provided "robust tick immunity," but more research is needed to see if it provides similar protection to humans, the research team reported Wednesday (Nov. 17) in the journal Science Translational Medicine.

"This is the proof-of-concept that this is possible," said Petr Kopáček, a senior scientist at the Institute of Parasitology at the Czech Academy of Sciences in South Bohemia, who was not involved in the study.

Triggering anti-tick immunity

Whether it works in humans remains to be seen.

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Some animals, including guinea pigs and rabbits, develop a natural resistance to tick bites after being repeatedly bitten by the parasitic pests, said senior author Dr. Erol Fikrig, a professor of medicine who runs an infectious disease lab at the Yale School of Medicine. These resistant animals develop an inflamed, red welt at the tick bite site, and this immune reaction interferes with the tick's ability to slurp down the animal's blood. Often, the tick will fall off the animal without completing its meal — and before pathogens can be transferred.

And anecdotal evidence suggests that humans can build up such resistance to ticks, as well, Fikrig told Live Science. So Fikrig and his team wondered if humans could be granted tick immunity, through a vaccine, and thus become better protected from tick-borne pathogens like B. burgdorferi.

"When a tick feeds, it takes a bit of time for the Lyme vector to be transmitted," Fikrig said. Typically, a tick must remain attached to its host for 36 to 48 hours for the bacteria to transfer over, according to the CDC. The tick's spit actually helps it to avoid discovery during its feeding, because the pest's saliva contains proteins that suppress the host's immune response, which reduces the amount of pain and inflammation triggered by the bite.

Fikrig and his team decided to use these ticks' spit proteins against them, by designing a vaccine that mounts an immune response specifically against those proteins.

In total, they chose 19 tick spit proteins to target, some of which suppress the host immune response and others that help the tick feed — for example by dilating the host's blood vessels and preventing the blood from clotting. The team then generated mRNA, a type of genetic molecule, that contained instructions on how to build each spit protein, and packed that mRNA in lipid nanoparticles, or tiny bubbles of fat. Once injected into guinea pigs, the mRNA directed the guinea pig cells to build the tick saliva proteins and trigger a subsequent immune response.

The COVID-19 vaccines designed by Pfizer-BioNTech and Moderna also use mRNA, but those vaccines instruct human cells to build coronavirus proteins. "Reviewing this manuscript, I was quite excited, because it's the first effort to get an mRNA vaccine against ticks," Kopáček said.

Two weeks after vaccinating the guinea pigs, the team examined their blood and found specific antibodies against 10 of the 19 tick proteins included in the vaccine. The researchers then placed uninfected black-

legged ticks on the animals to see if their bites would trigger an immune response. The vaccinated guinea pigs developed "substantial" redness around the tick bites within 18 hours, and this redness peaked at 24 hours. By comparison, a group of unvaccinated guinea pigs showed little redness around their bites.

The ticks attached to the vaccinated guinea pigs consumed little blood and began to detach within 48 hours; 80% had completely detached after 96 hours, while only 20% of ticks on the unvaccinated guinea pigs fell off within the same time period.

To see whether the vaccine could help reduce the risk of Lyme disease from a tick bite, the team conducted a second experiment, in which they placed three B. burgdorferi-postive ticks on each guinea pig. (It only takes one infected tick to cause Lyme disease.)

Given that humans would likely notice and remove a tick if it caused substantial redness on their skin, the team removed the ticks from the guinea pigs once redness developed around their bites. Following the experiment, six of the 13 unvaccinated guinea pigs tested positive for B. burgdorferi, but none of the vaccinated guinea pigs did.

"The authors demonstrated that early tick removal, together with the [vaccine]-driven inflammatory reaction around the tick bite, is a key step toward the development of a vaccine for preventing Lyme disease transmission," Kopáček and several colleagues wrote in an accompanying commentary, also published in Science Translational Medicine.

Theoretically, the new vaccine may not only guard against Lyme disease but also prevent the transmission of other tick-borne pathogens, such as Babesia microti — a parasite that causes the illness babesiosis, which destroys red blood cells, according to the CDC. But this would need to be demonstrated in future studies, Fikrig said. He and his colleagues hope to pursue such studies in animal models, and in the meantime they are studying each of the tick saliva proteins in the vaccine, to see which are most important for generating immunity from ticks.

This research is in its early stages, so a human version of the anti-tick vaccine likely won't be available anytime soon. The authors suspect that humans may respond to the vaccine "in a manner similar to guinea pigs," because neither people nor guinea pigs are important to the natural life cycle of I. scapularis and both show (at least anecdotal) resistance to tick bites over time. Mice, on the other hand, act as one of the primary food sources for young ticks, and don't build up resistance to their bites; as part

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of the new study, the authors tested their vaccine on mice and found they did not develop any skin redness after tick exposure.

For humans, "I think showing safety would be the most important thing," on top of showing that the vaccine works, Fikrig said. For instance, it's unclear whether the vaccine could trigger hypersensitivity to other biting arthropods. "If there's hypersensitivity, I'd expect it to be another tick species," rather than another blood sucker, such as mosquitoes, but this still needs to be tested, Fikrig said.

A future vaccine for humans could potentially combine the new, tick-targeting vaccine with one that targets the B. burgdorferi bacteria directly, Kopáček said. "I can imagine that this mRNA technology can easily combine both approaches," which together would provide even more protection against Lyme disease, he said.

Several vaccines that target B. burgdorferi are now in clinical trials, and one such vaccine was actually approved in the 1990s, but it was discontinued in 2002 due to "insufficient consumer demand," according to the CDC. But the threat of Lyme disease seems to be better recognized now, and federal institutions are once again investing in Lyme disease vaccine development, Time reported.

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livescience.com, 18 November 2021

https://www.livescience.com

Primary-colored poison: Lead paint still a major threat to Indonesian kids

2021-11-17

- Nearly 70% of commercially available paints in Indonesia contain levels of lead higher than the regulatory safe limit of 600 parts per million (ppm).

- That's the finding from an analysis of solvent-based paints in 10 Indonesian cities, which also estimates that 33 million children are exposed to lead paint on a daily basis.

- The association of paint manufacturers says it may consider adopting a safe limit of 90 ppm, the same as the World Health Organization prescribes, but that many of the small manufacturers that still use lead aren't part of the association.

Heavy metals like lead are particularly toxic for children.

- Advocates have called for stronger regulations governing sales of lead-based paints, including lead content information to be published on paint cans.

MEDAN, Indonesia — At the corner of Sei Batanghari Road in Medan, the capital of Indonesia's North Sumatra province, kindergarten students run around a building in their school uniforms. The bell to call them back to class hasn't rung yet. Most of the kids are enjoying the playground's slides and swings. Almost all of the playground equipment is painted in bright primary colors: yellow and red, blue and green. In their classrooms, the tables and chairs are also painted bright colors.

A similar scene plays out in nearby Beringin Park, in front of the governor's office, where more children play on playground equipment provided by the local government. Much of the equipment here is also coated in bright shades of red, yellow and blue paint.

Medan is hardly unique in this regard; many cities feature public facilities for kids painted in bright colors. But in Indonesia, those shades of paint, meant to make things appear more kid-friendly, actually makes them more of a serious health risk to children, according to a new study showing that a large percentage of the paints produced and used in Indonesia, particularly the brightly colored kinds used around children, contain dangerously high levels of lead.

The study was produced by the Nexus3 Foundation, an Indonesian nonprofit working to safeguard the public from environmental toxins, and the International Pollutants Elimination Network (IPEN). It found that most wood and metal paints in Indonesia still contain high concentrations of lead, many with more than 600 parts per million (ppm), the regulatory safe limit.

Heavy metals like lead are particularly toxic for children. Exposure can damage the brain and nervous system, slow growth and development, and cause learning and behavioral problems, all of which can lead to lower IQs.

It is estimated that there are around 33 million school-age children in Indonesia who are exposed to lead paint on a daily basis, often in environments like schools and playgrounds where children eat as well, making the risk of accidental ingestion or exposure much greater, according to the study.

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Yuyun Ismawati, a senior adviser for Nexus3, said they tested 120 cans of paint from various brands chosen randomly from a number of construction supply stores in 10 of Indonesia's largest cities: Jakarta, Bogor, Depok, Tangerang, Bekasi, Bandung, Yogyakarta, Surabaya, Sidoarjo and Denpasar.

Out of the 120 paints they tested, 101 were solvent-based, eight were water-based, three were anti-rust, three were spray paints, and five were industrial-grade paints meant for road markings.

"The paints included in the research sample consisted of 66 brands produced by 47 manufacturers. Of the 120 paints, we found that 78% of them were produced nationally, 4% were locally made and 18% were produced by multinational companies. They were all chosen at random," Yuyun said in an online discussion about the report.

Nexus3 applied all of their paint samples to wood and let them dry for three days before sealing them for transport to the SGS Forensic Laboratories in San Francisco, which specializes in analyzing lead content.

The results from their laboratory testing found that 39% of the paint samples had lead content of more than 10,000 ppm, far exceeding the 600 ppm limit established by the Indonesian National Standard (SNI). The SNI is the minimum regulatory standard that all commercial products in Indonesia are supposed to meet before they can be sold to the public.

Another 29% of the paints they sampled contained lead levels between 600 ppm and 10,000 ppm, and 5% contained between 90 ppm and 600 ppm. Only 27% of the samples contained lead below the 90 ppm limit set by the World Health Organization.

Yuyun said bright primary-colored paints had some of the highest levels of lead detected by the lab. The most dangerous paint color was orange, with 91% of their orange samples containing more than 10,000 ppm of lead. Similarly high levels were found in 57% of green samples, 55% of yellow samples, and 18% of red samples.

"Brightly colored paints with high lead content are widely used in children's facilities and public spaces," Yuyun said. "Bright colors are good for stimulating children's minds. But if the paints used contain high levels of lead, the impact can also be very bad for a child's brain development."

Indonesia does not yet have a legally binding regulation prohibiting the use of lead in paint production. The current national standard allows for up

to 600 ppm of lead in organic, solvent-based decorative paints that can be sold to consumers.

"Our hope is that those paint companies that are still producing lead-based paints will transition to water-based paint products, which are much more environmentally friendly and safer for people's health, especially children," Yuyun said.

Lead is a heavy metal, making it very dangerous to human health, explained Dr. Andika Pratama, a pulmonologist at the University of North Sumatra's teaching hospital. He said heavy metals can cause nervous system disorders that trigger a decrease in nervous system response, depression and loss of appetite. Lead has also been shown to lead to long-term reductions in children's IQs and systemic disorders, such as gastrointestinal disorders, abdominal pain, constipation and an increase in blood pressure. He said lead also causes bone disorders because it can interfere with the function of calcium.

Dr. Andika said sudden exposure to a large amount of lead, such as through accidental ingestion, can quickly cause clinical symptoms such as fever, shortness of breath and even respiratory failure. But the way most children are exposed is over time in small amounts. That kind of exposure can interfere with the production of red blood cells and impair neurological growth in children.

"These symptoms sometimes escape the attention of parents because the impact of lead is not like other diseases, where the symptoms are visible to the naked eye," Dr. Andika said. "That is why parents need to be educated about these symptoms."

Pushing for a lead paint ban

Fajri Fadhillah, the head of the pollution and environmental damage control division at the Indonesian Center for Environmental Law, a nonprofit, said that based on an analysis by the United Nations Environment Programme (UNEP), the cost burden on Asian countries caused by a decrease in IQ due to exposure to lead paints is nearly $700 billion per year.

Fajri noted that the U.S. has long been working to eliminate lead from homes and spends billions of dollars on removing lead from buildings each year. "That is not a small expense," Fajri said.

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He said the flow of lead into Indonesia starts with foreign suppliers of raw lead, which is sent to pigment manufacturers who sell to the distributors that sell pigments to paint producers.

Indonesia, Fajri said, needs to have a regulation prohibiting trade in lead-based paints. He said such a regulation would benefit both public health as well as paint producers themselves since it would prevent competitors from using lead as a way to undercut production costs.

Fajri also urged President Joko Widodo to use executive power to issue a regulation mandating that information regarding lead content be placed on paint packaging so that the public can make informed decisions.

The Indonesian government still largely relies on the paint industry to establish manufacturing regulations and monitor standards.

Markus Winarto, the secretary-general of the Indonesian Paint Manufacturers Association (APCI), said paint companies still make lead-based paints for many reasons. One of those is that lead pigments are both cheaper and more durable than water-based paints.

"It's weather-resistant and the production process is also easier. Most importantly, there is still demand for it in the market," Markus said.

He said current regulations allow for organic solvent-based paints to include lead content of up to 600 ppm, but added the APCI is working on revising that number down to 90 ppm, which would be in line with WHO standards. However, Markus said this is still up for discussion among the association's members. He said it would be difficult for smaller manufacturers to meet more stringent standards. Markus also noted that many of Indonesia's smaller paint manufacturers are not members of the association, making standards enforcement difficult.

Nexus3 noted in its report that samples taken from 32 public playgrounds in the capital city, Jakarta, were found to have lead paint, some containing up to 100,000 ppm. Jakarta Deputy Governor Ahmad Riza Patria responded to media coverage of the report by saying that the current administration only uses international standard paints for children's facilities and that any paint with high lead content came from previous administrations. He said efforts would be made to remove the lead content from older facilities.

Indonesia is one of many countries where public health advocates are pushing for bans and restrictions on lead-based paints. According to the U.N., 79 countries have legally binding regulations to limit the production,

import and sale of lead paints, which is just 41% of all countries. The Global Alliance to Eliminate Lead Paint, a partnership between UNEP and the WHO, is one of many organizations working to pass lead-based paint regulations in countries around the world and promote the eventual phaseout of all lead-based paints.

news.mongabay.com, 17 November 2021

https://www.news.mongabay.com

Ikea says it will eliminate plastic packaging by 2028

2021-11-22

In the past, if you bought LED lightbulbs at Ikea, they probably would have been in a plastic blister pack—something that's both hard to open and likely to end up in the trash, since most plastic packaging isn't recycled. But the company's newest line of bulbs now comes in paper boxes instead. It's one step in Ikea's plan to systemically phase out plastic packaging.

By 2025, all new Ikea products will come in plastic-free packaging, with the exception of some food products that need to use it for food safety and to prevent food waste. By 2028, all existing products will also be packaged without plastic, part of Ikea's larger goal to transition to become a fully "circular" company.

Many new packages will use paper, though the company is exploring other materials. "Paper is a very good material to use because it does come from renewable sources, and it has quite strong circular capabilities," says Maja Kjellberg, packaging innovation leader at Ikea. "But we're not limiting ourselves to paper. We do want to use other materials going forward. And we have an innovation program ongoing right now where we're scouting on startups and scale-ups to find new ways of packing products and other materials that aren't wood and fiber based."

The company previously explored mushroom-based packaging to replace styrofoam, for example, though for now, it's too difficult for manufacturers to produce the scale of packaging Ikea needs. Other startups are exploring packaging materials made from waste from the food industry, from coconuts to the byproducts of beer brewing. Ikea is also beginning to use waste from its own production in some packages, such as packaging for textiles sewn from scraps of the material.

The company currently spends more than 1 billion euros a year (close to $1.1 billion) on around 920,000 tons of packaging material. Much of it is already paper; for furniture in cardboard flat packs, Ikea shifted away from

Many new packages will use paper, though the company is exploring other materials.

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using polystyrene packaging inside the boxes several years ago, replacing it with cardboard tubes and other paper supports. Only around 10% of the company's packaging is now plastic. Of what remains, some is harder to change than others.

For many years, we've been using plastic, and it's been driving costs down but also driving us further away from our sustainability goals," says Kjellberg. "I think you have to really look at the range and to look at the specific product and see, [why] are we really using the plastic? In some cases, maybe there isn't always a very clear reason, and then it's actually quite easy to get rid of that plastic, whereas in other cases, we're using plastics for a very specific reason. And then it can be a bit more difficult to find the right solution to still ensure product quality and to enable automation, and at a price that is affordable, [so we] can offer affordable products to our customers."

When Ikea uses plastic in some food packaging, both because of regulatory requirements and performance, it plans to shift to recycled or plant-based material rather than virgin plastic made from fossil fuels. "Plastic for now is, in many cases, the most sustainable option, compared to packing something in paper, and then the shelf life would be much lower, or you'd have more food waste, which is even worse from a sustainability point of view," Kjellberg says. "So plastic will be used in food. But when we still have to use the plastics, we will make sure that they are from renewable sources or recycled."

fastcompany.com, 22 November 2021

https://www.fastcompany.com

New high-speed video reveals the physics of a finger snap

2021-11-16

It all happens in a snap. New high-speed video exposes the blink-and-you'll-miss-it physics behind snapping your fingers.

The footage reveals the extreme speed at which the gesture occurs, and shows that friction plus the compressibility of the finger pads are key to humans' ability to snap properly, researchers report November 17 in Journal of the Royal Society Interface.

Finger snaps last only about seven milliseconds — that's roughly 20 times as fast as the blink of an eye, says biophysicist Saad Bhamla of Georgia

And a snapping finger accelerates almost three times as fast as pitchers' arms.

Tech in Atlanta. After slipping off the thumb, the middle finger rotates at a rate up to 7.8 degrees per millisecond, nearly what a professional baseball pitcher's arm can achieve, the team found. And a snapping finger accelerates almost three times as fast as pitchers' arms.

When covered with high-friction rubber or low-friction lubricant, fingers made snaps that fell flat, the team found, indicating that bare fingers have a level of friction ideal for a speedy snap (SN: 8/1/19). That friction between thumb and middle finger allows energy to be stored before it's suddenly unleashed. Too little friction means less pent-up energy and a slower snap. But too much friction impedes the finger's release, also slowing the snap.

Bhamla and colleagues were inspired by a scene in the 2018 movie Avengers: Infinity War. The supervillain Thanos snaps his fingers while wearing a supernatural metal glove, obliterating half of the universe's life. The team wondered if it would be possible to snap while wearing a rigid glove. Typically, when the fingers press together in a snap, they compress, increasing the contact area and friction between them. So the researchers tested snapping with fingers covered by hard thimbles. Sure enough, the snaps were sluggish.

So Thanos' snap would have been a dud. No superheroes needed: Physics saves the day.

sciencenews.org, 16 November 2021

https://www.sciencenews.org

Evidence of Hanukkah's Maccabee rebellion unearthed in Israel

2021-11-24

Archaeologists have discovered the burned remains of an ancient Hellenistic fortress in Israel that fell to Jewish rebels more than 2,000 years ago.

A guerrilla army called the Hasmoneans, also known as the Maccabees, defeated and set fire to the citadel during the revolt that is commemorated by the Jewish festival of Hanukkah. Researchers recently found the ruined stronghold at a site in the Lachshish Forest in the foothills of the Judean Mountains in southern Israel, representatives with the Israel Antiquities Authority (IAA), said in a statement.

The fort was destroyed around 112 B.C. — decades after the Hanukkah "miracle" took place in Jerusalem — at a time when a Maccabee leader

"The excavated building was badly burnt and devastated by the Hasmoneans."

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and Jewish high priest named Johanan (John) Hyrcanus was leading the Hasmoneans in their ongoing struggle for independence from the Seleucid Empire, IAA representatives said. SOUND

Located atop a tall hill, the fortress would have provided a strategic view of the main road and of nearby Maresha, a bustling and important capital city during the Hellenistic period. The building was likely "part of a fortified line erected by the Hellenistic army commanders" and was intended to protect Maresha against Hasmonean attacks, according to the statement.

"However, the finds from the site show that the Seleucid defenses were unsuccessful," IAA excavation directors Saar Ganor, Vladik Lifshits and Ahinoam Montagu said in the statement. "The excavated building was badly burnt and devastated by the Hasmoneans."

The fort's perimeter measured about 50 feet (15 meters) in width and length, and the external stone walls were approximately 10 feet (3 m) wide and were carved to slope outward, to foil climbers. On the inside, the archaeologists uncovered seven rooms that were roughly 6.6 feet (2 m) tall; a stairwell led to an upper level that was not preserved, but when that floor was intact the fort's height would have been about 16 feet (5 m), IAA representatives said.

Under the rubble of the fort's collapsed upper level, the team discovered hundreds of artifacts. After clearing away thousands of stones, the archaeologists excavated iron weapons, slingshots, pottery and coins dating to the second century B.C. Charred wooden beams told the scientists that the fort had been overwhelmed by military forces and burned by the victors, who were likely Hasmoneans under Hyrcanus' leadership.

The Hasmoneans began organizing their resistance against the Seleucids following King Antiochus IV's desecration of the Second Temple in Jerusalem in 168 B.C., according to the Department of Ancient Near Eastern Art at the Metropolitan Museum of Art in New York City. The Maccabees (the word means "hammer" in Hebrew) eventually reclaimed and rededicated the temple, but could find only enough ceremonial oil to light the temple's new menorah for one day. According to the so-called miracle of Hanukkah, that small quantity of oil burned for eight days — long enough for the temple priests to produce enough fresh oil to light the menorah anew each day. To commemorate the holiday, Jewish people light eight-branched menorahs over Hanukkah's eight nights.

The discovery of the fort offers a window into the battles and victories of the Maccabee rebels thousands of years ago, providing evidence of the traditional Hanukkah stories and helping to bring them to life, Hili Tropper, the Israeli Minister of Culture and Sports, said in the statement.

After excavation at the site is completed, the fortress will be conserved and then opened for visits by the general public, the IAA said.

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https://www.livescience.com

No, COVID-19 vaccines won't make you infertile

2021-11-11

It's one of the biggest industries in the world, consumes more than 10% of fossil fuels produced globally and emits an estimated 3.3 gigatons of greenhouse gas emissions a year, more than India's annual emissions – yet the chemicals sector has largely slipped under the radar when it comes to climate.

This sprawling industry produces a huge range of products, many of which support other industries – pesticides for agriculture, acids for mining, lubricants for machinery, ingredients in cleaning agents, cosmetics and pharmaceuticals and plastics.

While the industry has an important role to play in moving to low-carbon economies – providing coatings for solar panels, lightweight plastics to reduce vehicles' energy consumption and insulating materials for buildings – it's also hugely carbon intensive and predicted to become more so. Oil companies have been betting on chemicals as a way to remain profitable as the world pledges to turn away from fossil fuel energy. The International Energy Agency predicted that petrochemicals could account for 60% of oil demand in the next decade.

They've become a bit of an untouchable sector for many politicians

Jan-Justus Andreas

The chemicals sector is the largest industrial user of oil and gas but it has the third-largest carbon footprint – behind steel and cement – because only about half of the fossil fuels that the industry consumes are burned for their energy. The rest is used as feedstock for products such as plastics with the emissions released only when these products reach the end of

The International Energy Agency predicted that petrochemicals could account for 60% of oil demand in the next decade.

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their lives, for example, when waste plastic packaging or an old mattress is incinerated.

Lowering the industry's emissions is possible but technically daunting. Plus this large, complex industry, which supports millions of jobs worldwide, has significant political and economic clout. "They've become a bit of an untouchable sector for many politicians," said Jan-Justus Andreas, who leads industrial policy at the Norwegian environmental non-profit Bellona Europa.

Yet the chemicals industry is finding itself increasingly under scrutiny – both from nations that need to meet ambitious emissions reduction targets and from researchers, scientists and campaigners calling on the industry to cut its polluting products.

Moving away from dirty energy

One way to lower emissions is to focus on chemical plants – improving efficiency and switching to low-carbon energy.

Most of the industry's direct carbon dioxide emissions come from burning fossil fuels to power chemical transformations, many of which take place at high temperatures and pressures. These emissions could be significantly reduced if the industry moves away from dirtier fuels such as coal.

If renewable wind or solar energy is available, certain chemical processes that are already driven by electricity, such as the production of chlorine used to make other materials such as PVC pipes or solvents like chloroform, could immediately become low carbon. And chemists continue to look for ways to power traditionally heat-driven chemical transformations with electricity instead – such as the process of converting nitrogen to ammonia, mostly used for fertilizer, which requires temperatures of about 500C (932F).

While chemical companies are counting on efficiency improvements and investing in renewable energy to meet their climate goals, many chemical products themselves cannot be decarbonized because they are made of carbon, said Martin Scheringer, an environmental chemist at the public research university ETH Zurich.

Removing fossil fuels from the raw materials used to create carbon-based chemicals and materials is crucial, said Jonatan Kleimark of the non-profit ChemSec. Kleimark likens products made from fossil fuels – such as clothes, toys and paints – to a carbon debt, because the carbon embedded within them will only be emitted in the future. "The longer we wait to

change, the larger debt we will build, and that will be very hard to do something about if we don't start," Kleimark said.

To stop adding to this debt, chemicals and materials could be made with sources of carbon that are already above ground, such as plants. Bioplastics – made with plant materials such as sugar, corn or seaweed – are booming, for example, as companies and scientists try to remove fossil fuels from plastic production.

Another idea is to turn waste products into raw materials for the chemical industry. Chemists have been using agricultural waste or waste plastics – even the ultimate waste material, carbon dioxide – as feedstocks. A Berlin-based startup, Made of Air, is attempting to create plastics from wood waste, while an Icelandic company, Carbon Recycling International, turns captured carbon dioxide emissions into methanol, used in fuels and for making other chemicals such as formaldehyde.

'Why don't you deal with someone else first?'

But all these ideas – especially those involving a shift in feedstocks – are very hard to implement.

Technologies to turn agricultural or plastic waste into new chemicals are still unproven on a large scale and using carbon dioxide as a raw material will require vast amounts of zero-carbon energy.

Manufacturers making products with plants rather than fossil fuels need to ensure that they do not create new problems through deforestation, destroying wildlife habitat, raising food prices or increasing the use of water or pesticides. Biomass resources also tend to be more spread out, whereas traditionally, chemical plants stay close to where fossil fuel resources are easily accessible.

"With renewable feedstocks, you will need to reestablish new supply chains," said Zhanyun Wang, a senior scientists at ETH Zurich. In addition to delivering a steady stream of renewable raw materials to chemical plants, the new supply chains would need to be competitive with well-established ones making products from fossil fuels at low prices, Wang said.

The clean power infrastructure requirements alone are tremendous. Electrifying Europe's chemicals sector would require 4,900 terawatts of renewable electricity, according to an estimate by the European Chemical Industry Council, almost double the total amount of electricity Europe generated in 2019.

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"If you are a lobbyist for the chemical sector, showing those numbers helps you to put your head down again and say, 'Look, firstly I'm too important and valuable, and secondly, it's really, really difficult to deal with me, so why don't you deal with someone else first,'" Andreas said.

Currently, that someone else refers to the cement and steel industries, said Andreas. The internal competition between the three industries to avoid scrutiny is unhelpful, he said, because they could benefit from developing an industrial strategy together.

The exhaust gases from steel and cement plants could serve as valuable feedstocks for chemical plants. All three industries need large-scale renewable electricity or carbon capture facilities, which require significant investment. The financial risks involved in building these new facilities could be mitigated, Andreas said, if the new facilities serve multiple operations instead of a single steel mill or fertilizer plant.

Governments could also help build the necessary infrastructure or help companies gain access to renewable feedstocks, said Rebecca Dell, who directs the industry program at the San Francisco-based ClimateWorks Foundation.

But with less than 30 years to 2050, time is short. If there are no delays, typically, it takes about seven years for companies to get a new process up and running, Dell said. "We have to move a lot faster."

Simplifying products

One important, but neglected, lever for cutting emissions from the chemical sector is to simply use and produce fewer chemicals. "That would lead very directly to a reduction in CO2 emissions and also reduce the toxification of humans and the environment," Scheringer said.

The overuse of materials such as plastics, fertilizers and other synthetic chemicals has caused devastating effects on ecosystems and human health. Plastic debris chokes waterways and wildlife, fertilizer-laden runoff from fields can cause algal blooms and create dead zones in coastal areas.

These impacts have led policymakers and consumers to cut back – for instance, many cities and countries now have prohibitions on some single-use plastics. "It's an attempt to reduce plastic itself as a pollutant in the landscape, more than concerns about greenhouse gases, but we can make simultaneous progress on more than one front," said Dell.

Studies have also found that being more precise about applying fertilizer could save farmers money and keep greenhouse gases out of the atmosphere.

It is less straightforward to cut back on some of the chemicals that are used to make consumer products, but Scheringer, Wang and others have proposed a way to start. Alarmed by the dangers of some cancer-causing PFAS, also known as "forever chemicals", researchers have suggested eliminating PFAS from their "nice-to-have" applications – such as nonstick cookware, long-lasting mascara, or water-repellent surfer shorts that don't need the level of high performance that "forever chemicals" confer.

The researchers recommend that "forever chemicals" be used only in really important products, such as protective gear or medical devices that save lives. The same philosophy could be applied to identify and eliminate other chemicals that have been unnecessarily formulated in products, such as adding antimicrobials to soaps that can already kill germs.

Simplifying the chemical ingredients in products has an added benefit: they are easier to take apart or recycle when they are no longer useful. Wang points to the example of carbon black, the chemical used as a pigment in food takeout boxes. The pigment serves no technical function other than providing colour and it is used because food looks more appealing set against a black background, Wang said. But the pigment also means the takeout boxes are invisible to devices that use light to sort plastics at sorting facilities, making them impossible to recycle.

The chemical sector is producing more than consumers need, Wang said: "The business model is driven by how many chemicals you sell, it's not necessarily driven by the added societal value of the chemical."

But the "enormous demand" for products is also a big driver – and perhaps harder to address, said Kleimark. "We're standing in front of a really, really big challenge because there we cannot rely on technologies, but on changing the way we do things today."

sciencenews.org, 11 November 2021

https://www.theguardian.com

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A deadly disease is wiping out coral in Florida and the Caribbean

2021-11-16

A silent killer is spreading throughout the waters of the Caribbean. Known as stony coral tissue loss disease, it afflicts at least 22 species, including some of the largest, oldest, and most important reef-building corals. Infected colonies develop white patches that slowly enlarge, draining the color and life from the animals. In the most susceptible species, such as pillar, brain, and star corals, infected colonies usually die within weeks or months.

It's the "worst thing I've ever seen," says William Precht, a coral disease specialist in Florida.

Stony coral tissue loss disease, abbreviated as SCTLD, was discovered in the fall of 2014 in corals off Miami. The disease, likely spread by a bacterium or virus or some combination thereof, has already expanded throughout Florida's coast and much of the northern Caribbean. It's now present in at least 20 countries, from Mexico to Honduras to St. Lucia. And in May 2021, corals became infected with the disease in Florida's Dry Tortugas National Park, a hot spot for coral diversity.

It's the "worst thing I've ever seen," says William Precht, a coral disease specialist in Florida.

Researchers, including Precht, are racing to discover what causes the condition, how it spreads, and how to help treat it. Though the disease propagates slowly via water currents, new research suggests that it may also be spread by commercial shipping vessels at major ports, such as in the Bahamas.

Caribbean corals—which form the basis of their reef ecosystems—are already threatened by warming waters due to climate change, pollution, nutrient runoff, and more, which makes solving the mystery all the more pressing.

'Absolutely sickening'

The summer of 2014 was bad for coral in Florida. A heat wave caused the water temperature to jump to a record high off the coast, causing a massive bleaching event. This happens when stressed corals expel the symbiotic algae, called zooxanthellae, that keep them alive. Corals can recover from bleaching, but it can weaken and leave them susceptible to disease. (Read more: Acidification threatens Florida's coral reefs.)

At the time, Precht, the chief scientist of a Miami-based environmental consulting company, Dial Cordy and Associates, was running a series of

monitoring stations on coral reefs around Miami to keep track of any impacts caused by a dredging project in the area.

In October, one of the company's divers, named Ryan Fura, saw a few corals that looked "a little funky" on a reef a short distance from the outflow of the Miami-Dade County water treatment plant, Precht recalls. Over the next few weeks, the as-yet-unknown ailment seemed to spread rapidly. Precht visited the affected reef in early November to check it out himself.

More than half of the corals appeared to be infected, and some were already dead. "I couldn't believe my eyes," he says. "It was absolutely sickening."

How is it spreading?

The disease's appearance elsewhere has often been likewise sudden—and devastating. In October 2019, the disease had not yet arrived in the Bahamas, in part because the prevailing ocean current runs northward up the Florida coast. That month, marine ecologist Craig Dahlgren and colleagues surveyed about 60 miles of reef and found no sick coral. Yet by November, the team was getting reports that corals near Freeport had an unknown infection—which soon proved to be SCTLD.

During another extensive survey in March 2020, Dahlgren, with the Perry Institute for Marine Science, once again surveyed more than 60 miles of reef—and found infected corals in every site, particularly brain and pillar corals. Within months, the vast majority of the infected colonies were dead.

Many of the affected corals form the dominant structures of reefs—such as the large, striking columns of pillar corals—and can live for centuries.

"Colonies that took hundreds of years to grow can be wiped out in a matter of weeks," he says.

In July 2021, Dahlgren and co-authors published a study showing the disease radiated from the commercial ports of Freeport and Nassau. A reasonable explanation for this pattern is that commercial shipping vessels are spreading the disease, Dahlgren says. One possibility is that the pathogens are being carried in commercial ships' ballast water, which is held in tanks to stabilize these huge vessels. However, more research needs to be done to confirm this hypothesis, Precht says.

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The disease also arrived suddenly in the U.S. Virgin Islands in January 2019, near the commercial shipping port of Crown Bay, on the Island of St. Thomas. It then gradually spread around the island and to neighboring St. John, jumping suddenly to two separate locations in St. Croix—both near commercial shipping ports, says Marilyn Brandt, who studies coral at the University of the Virgin Islands, on the island of St. Thomas.

The disease has been devastating to Virgin Islands reefs, which in some places have lost between a half and three-quarters of their coral within two years of the first infection, she says.

"Everything I've seen in the past pales in comparison to this," says Brandt.

Brandt fears the loss of coral will harm fish populations, as well as negatively impact the economy, which depends heavily on coral reef snorkeling and diving tourism.

The coast guards of various countries, such as the Bahamas, have issued recommendations to ships to not exchange ballast water within ports, but so far, few enforceable laws have been passed to stop the practice.

To prevent the disease from spreading between islands, ships need to be more careful about how and when they exchange ballast water, and avoid releasing it near ports and coral reefs, Dahlgren says. (Learn more: Window to save world's coral reefs closing rapidly.)

The search for a cause

Nobody knows for sure yet what causes the disease—but dozens of researchers are working to identify it.

One tantalizing clue emerged in a case report published online this fall by U.S. Geological Survey researcher Thierry Work. While peering at infected coral cells with an electron microscope, he noticed that that these corals' zooxanthellae cells appeared to be full of holes. Within the degraded cells, he found curious strand-like particles—"like packed spaghetti," Work says.

These strands turned out to be unidentified viruses, similar in size and shape to plant viruses in the family Flexiviridae. Work can't prove that these viruses are causing the disease, but he suspects that they are playing an important role, and several researchers are following up on this finding.

But there are reasons for skepticism. For one, infected corals respond well to antibiotics, which kill bacteria, not viruses. On the other hand, antibiotics can have stimulatory effects on the immune system that cause

effects beyond their intended targets. Preliminary work also shows some infected corals respond favorably to antiviral treatments.

Secondly, seemingly healthy corals that Work examined also had viral particles in their zooxanthellae. But Work thinks that these corals might not have been as healthy as assumed—and that perhaps they, too, were likely to get sick in the future—or had asymptomatic disease.

Some researchers suspect a bacterium is a more likely culprit. Brandt and Erinn Muller, a biologist with the Mote Marine Laboratory in Sarasota, looked at what types of bacteria were most prevalent in diseased corals in the Virgin Islands and Florida, respectively.

Precht agrees the cause is likely a bacteria, perhaps similar to one that causes a known coral disease called white plague.

A bath of microbes

There is likely no single culprit, either. For one, heat-stressed corals are more likely to be infected by any pathogen. In addition, coral diseases are often caused by more than one pathogen.

"It has to be complex, because there's not a clear signal that's come out of any of our studies," says Amy Apprill, a biologist with Woods Hole Oceanographic Institution who has studied the disease. She suspects there's a complicated interplay between one or more pathogens—perhaps even including bacteria and viruses—and the microbiome of the coral.

Julie Meyer, a marine microbiologist at the University of Florida, agrees that it's likely a disease caused by multiple microbes. As part of her research, she's sequenced the genome of all microbes present in the coral to look for clues about a cause.

One reason the research is so challenging is that "the ocean is basically a bath of bacteria and viruses," Meyer says. Furthermore, not much is known about coral diseases in general, or the intricacies of coral immune systems—let alone the immune systems of the 22 different affected species.

On the plus side, there's a massive amount of research going on right now, with multiple papers submitted for publication every week.

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"This is a huge crisis," Brandt says. "The whole community is throwing everything they have at this."

nationalgeographic.com, 16 November 2021

https://www.nationalgeographic.com

Dead tapeworm in man's brain caused him to speak 'gibberish' and have seizures

2021-11-19

A 38-year-old man in Boston went to the hospital with unexplained seizures. It turned out he had been living with a dead tapeworm in his brain for years, according to a new case report.

The man's wife called the police after her husband fell out of bed, started shaking and "speaking gibberish" in the middle of the night. When help arrived, the man was "combative" and "disoriented," and he resisted getting into an ambulance, according to the report.

When he arrived at Massachusetts General Hospital in Boston, he had another unexplained seizure. It wasn't immediately clear what was causing the seizures, as he had no previous history of them, or of any related disorders.

Doctors at the hospital gave the man medication to control his seizures and conducted various tests. Brain scans revealed swelling and three lesions in his brain — both of which are typical of a parasitic infection known as neurocysticercosis, which can cause seizures and headaches and sometimes lead to death.

People get infected with the parasite from ingesting the eggs of pork tapeworms (Taenia solium) in undercooked or infected pork. Those eggs can then hatch in the body, become larvae and travel around the body, including to the brain where they form cysts. An infected person can spread the tapeworm if they don't wash their hands properly after going to the bathroom; if that person were to contaminate food or surfaces with their hands, others could then catch the parasitic infection, according to the Centers for Disease Control and Prevention (CDC).

Pork tapeworm infections are most common in rural areas of developing countries where pigs roam freely and eat human feces, according to the CDC. But about 1,000 people are hospitalized for neurocysticercosis in the U.S. each year, most of whom have been to other countries where these tapeworms are more common.

When help arrived, the man was "combative" and "disoriented," and he resisted getting into an ambulance, according to the report.

Around 20 years ago, the patient in the case report moved to Boston from a rural area of Guatemala, where the infection is prevalent, according to the report.

"This gentleman was a little atypical, but not amazingly rare, in that his parasites were dead and calcified and there was no living parasite in his brain for one or two decades," study co-author Dr. Edward Ryan, the director of global infectious diseases at Massachusetts General Hospital, told The Washington Post. "The infection was long gone, but part of his brain was scarred — and that scarred area was leading to the seizures."

The parasites typically die in the body within five to 10 years, but they can continue to cause inflammation, leading to headaches, soreness and seizures, according to the Post.

The doctors treated the man with antiparasitic and anti-inflammatory drugs, and he was released from the hospital five days later, according to the study. The doctors followed up with the patient for the next three years, and the largest lesion in his brain has gone down, according to the Post. "He seems to be doing fine," Ryan told the Post. "The good news is he continues to do well and be seizure-free."

The findings were published Nov. 11 in The New England Journal of Medicine.

Originally published on Live Science.

livescience.com, 19 November 2021

https://www.livescience.com

Plastic pollution vs. a sustainable future

2021-11-19

Are we just going to keep making plastics and other endocrine-disrupting products until the environment is irreparably compromised and future generations are sterile?

Terry Collins, Teresa Heinz Professor of Green Chemistry and the Director of the Institute for Green Science at Carnegie Mellon University, recently laid out the case for revolutionary change in Amsterdam, at the Plastic Soup Foundation's Plastic Health Summit 2021.

Plastic pollution 'as ominous as climate change'

"Wherever you look at a highly chemicalized societies, you see low birth rates."

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Endocrine disrupting chemicals – synthetic compounds that act like hormones at vanishingly tiny concentrations in our bodies and hijack hormonal functions like brain development and fertility – represent a problem for society, Collins said, "at least as ominous as climate change and probably faster moving but quietly so."

"There's an Everest of scientific information and cultural information saying that we have not been diligent in managing the power of the chemical enterprise," he said. "Wherever you look at a highly chemicalized societies, you see low birth rates."

Solution to plastic pollution

So what can we do? At the risk of spoiling the 16-minute clip above, Collins pointed to four steps:

- Learn how to make profitable chemicals that are sustainable.
- Test for endocrine disrupting chemicals.
- Move from a "money first" to a "sustainability first" regulatory and market model.
- Learn how to love the future.

The principal challenge, he added, is to prove that democracies can bring down a corrupt power.

Worth the watch...

ehn.org, 19 November 2021

https://www.ehn.org

Bird flue: What is avian flu, how does it spread, which viruses infect humans and should we be worried?

2021-11-23

The COVID-19 pandemic may have crushed seasonal flu to historically low levels, but another type of flu — avian influenza or bird flu — has showed no signs of slowing.

In the past month, severe bird flu has popped up in poultry farms across Europe and Asia, with Japan confirming its third outbreak for the winter season so far.

The outbreaks follow Japan's worst winter for bird flu yet. More than 3 million chickens were destroyed in 2020-21.

Closer to home, six Victorian farms, including an emu farm, culled hundreds of thousands of birds in 2020 and early 2021 after multiple outbreaks involving three different strains of the virus.s audio has expired

While bird flu viruses do generally stick to infecting birds, they occasionally make the potentially deadly leap to other animals, including humans.

In May, for instance, the first confirmed human case of a rare bird flu subtype was reported in China.

Ricardo Soares Magalhães, an infectious disease epidemiologist at the University of Queensland, says this recent spate of new bird flu strains that can hop to humans is unusual.

"Usually, you'd see these viruses just affecting the poultry population, and very few human cases, or none at all," Dr Soares Magalhães said.

"But most of the different examples we've had in the last year-and-a-half have been viruses that had some human transmission."

And despite the COVID-19 pandemic being driven by a coronavirus, epidemiologists are "very wary" when it comes to emerging flu strains, he added, with influenza still at the top of pandemic-potential diseases.

What is bird flu and where does it come from?

Bird flu is caused by a handful of influenza viruses, just like the seasonal flu that circulates each winter.

ABCs of Hs and Ns:

While bird flu viruses do generally stick to infecting birds, they occasionally make the potentially deadly leap to other animals, including humans.

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- Influenza A viruses, which infect humans and animals, are classified into subtypes depending on two spike proteins that cover their surface:
  - haemagglutinin
  - neuraminidase
- There are 18 different haemagglutinin (H1 to H18) and 11 neuraminidase (N1 to N11) proteins
- Each virus has one type of H and one type of N (such as H1N1 and H3N2)

But while seasonal flu infections rise in cool weather, drop off in spring and spread easily in human populations, bird flu — with the odd exception — is transmitted only between animals or from animals to humans.

It mostly circulates in wild birds, and spreads when migratory waterfowl fly between their summer and winter homes.

Larger birds, such as ducks and geese, tend to ferry bird flu viruses around the world, said Frank Wong, a CSIRO Australian Animal Health Laboratory microbiologist and World Organisation for Animal Health reference expert for highly pathogenic and low pathogenic avian influenza.

(Generally, if smaller migratory birds such as shorebirds are infected with bird flu, they're more likely to delay their migration, or not set out on their journey at all.)

And now, it's peak autumn waterfowl migration time in the northern hemisphere, which is why European and Asian countries are seeing an uptick in bird flu outbreaks, Dr Wong added.

"When the birds congregate [to feed and breed] … mixing of birds also results in mixing of viruses, including influenza viruses. Then when the birds fly south or westwards for the winter, they carry those viruses with them.

"If those wild birds interact with domestic birds, the viruses they're carrying might spill over and cause outbreaks in domestic poultry."

Free-range farming may increase spillover odds too.

YOUTUBEVictoria's worst outbreak of bird flu is raising questions about free-range farming.

Most bird flu viruses out there are low pathogenic strains, causing little to no disease to the wild birds that carry them.

But the problem is they can quickly become highly pathogenic, incredibly contagious and lethal.

Once a highly pathogenic bird flu virus has made its way into a poultry farm, it can spread rapidly and devastate entire flocks.

What's the bird flu situation in Australia?

Australia is in a pretty good place when it comes to bird flu.

There have been only eight outbreaks of the disease in Australia since the 1970s, with the biggest happening in Victoria last year.

Unlike Europe and Asia, Australia has no large waterfowl seasonal migrations from abroad, which bring in new viruses each year, Dr Wong said.

"Australian wild ducks are different species to migratory ducks and geese up in the northern hemisphere.

"Our endemic species of ducks are what we call nomadic. They don't travel according to the seasons — they mainly stay within the Australo-Papuan region — and they move according to drought and rain cycles."

Australia also has stringent controls around how poultry is shuttled into and around the country.

What are the symptoms of bird flu?

- Sudden death
- Difficulty breathing, such as coughing, sneezing, or rasping
- Swelling and purple discolouration of the head, comb, wattles and neck
- Rapid drop in eating, drinking and egg production
- Ruffled feathers, dopiness, closed eyes
- Diarrhoea

And the National Avian Influenza Wild Birds surveillance programme analyses bird poo and the like to keep tabs on the low-pathogenic H7 strains circulating in the wild, Dr Wong said.

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Among other biosecurity measures, local regulations state that poultry farms cannot be located near lakes or other bodies of water, Dr Soares Magalhães said: "Just being a few kilometres away can be a risk factor."

That's because the virus doesn't always need direct contact or faeces to spread between birds.

"Because it's a respiratory virus, it can be aerosolised at very large distances. So having those water bodies nearby will attract wild birds, and that means you will have a greater chance of transmission through the air."

Still, these measures aren't completely watertight. And if bird flu is detected in an Australian poultry farm, the policy is clear.

"In Australia, we don't want these viruses around, so regardless of if it's a low pathogenic strain or a high pathogenic strain, depopulation is the way to go," Dr Soares Magalhães said.

Depopulation — or culling — may seem an extreme measure, but the disease can quickly cause debilitation and death, especially if it's a highly pathogenic strain.

"The best strategy from an animal welfare perspective is to depopulate the flock," Dr Soares Magalhães said.

"That happens on a radius of 3 kilometres around the affected zone, and then we impose a surveillance zone out to another 7km."

So that's birds. What about humans?

For a human to get bird flu, they need direct contact with infected birds, or contaminated feathers or faeces. It can't be passed on by eating eggs and cooked meat.

So far, there's been very little human-to-human bird flu transmission, but that doesn't mean new strains won't gain that ability, Dr Soares Magalhães said.

"COVID [which probably originated in bats] is a good example of that."

Pigs can be infected with more than one flu virus, and if that happens, they can act as a virus mixing vessel of sorts to produce new viruses.

Influenza's genetic code, which dictates qualities such as the animals it infects and its contagiousness, is stored as a strand of RNA. If two (or more) influenza viruses meet in a pig's body, they can swap sections of that RNA strand.

Most of the time, these mutations die out. Occasionally, they might spawn a particularly pathogenic strain.

"The H5N1 virus is a good example of a virus that emerged through the interaction of a poultry virus with a swine virus, and has elements of a human virus," Dr Soares Magalhães said.

"But there are some exceptions to that rule.

"H7N9 is a virus that did not need a pig at all. It came straight from chickens to human beings."

Which are the viruses to watch?

Of the different bird flu viruses, H5 and H7 subtypes have the propensity to mutate from low to high pathogenic strains.

The H5N1 subtype, for instance, was first detected in a human in Hong Kong in the 1990s and, in 2003, kicked off a major bird flu outbreak, killing at least 280 people.

There have been more than 860 confirmed cases of H5N1 in humans to date, 456 of whom died.

"The current lineage of highly pathogenic H5 that's causing outbreaks in the northern hemisphere has adapted to be more amenable for infection in many different wild bird species, including ducks and geese," Dr Wong said.

"This has allowed it to have this rapid seasonal spread, when the conditions are right."

Then there's H7N9, which was first reported in humans in China in 2013. It has been reported in more than 1,500 people since and can cause severe disease.

What makes this virus trickier to contain is that it doesn't produce many symptoms in birds.

"That virus is actually a little more insidious," Dr Wong said.

"When a low-pathogenic H7N9 circulates in chickens or ducks, it's harder to spot because the chickens or ducks may not show signs of disease.

"And the right interplay of genes that virus carried [allowed] multiple spillovers into humans."

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Just recently, a third H type was found in humans. China reported that a H10N3 virus hospitalised a 41-year-old man.

When it was detected in birds, epidemiologists weren't overly concerned about it spilling over into humans, because there's no history of H10 viruses infecting us, Dr Soares Magalhães said.

"But then there was a human infection as a result of that virus, and the mechanism of transmission was similar to H7N9, whereby there was no indication of pig involvement."

So how worried should we be about a bird flu pandemic?

The COVID-19 pandemic has seen more funding made available for surveillance programs for diseases such as bird flu.

But even before the pandemic, regions where most bird flu strains first popped up — such as China — really stepped up their poultry farm biosecurity strategies, Dr Soares Magalhães said.

"China will perhaps be the location where new viruses emerge, but they will stop it very quickly."

So it's very much a watch and wait scenario, but we might not have to wait too long.

Dr Soares Magalhães's spatial epidemiology group is helping a World Health Organization program rank countries in South-East Asia according to their capabilities to control diseases that, like bird flu, can jump from animals to humans.

But the part of the world he has an eye on is further afield.

"It's very likely that new viruses will start to emerge; not in the traditional countries where that has happened, but in [what was known as] the Eastern Bloc," Dr Soares Magalhães said.

Even though the biosecurity of farms in the region has been scaled up in the past couple of decades, it "still tends to be suboptimal", he said.

Neighbouring Poland is currently grappling with multiple outbreaks of highly pathogenic H5N1 bird flu.

"Poland is the largest poultry producer in Europe, so they have the largest at-risk population.

"No wonder Poland is bearing the brunt of this."

Climate change could encourage new strains of bird flu to emerge too. As the world warms, migratory birds may spend winter elsewhere, and mix with different bird populations — and viruses.

"Every single year, we will have wildlife-originated influenza viruses in the poultry population, and I'm sure there will be a time when a virus similar to H5N1 will pop up," Dr Soares Magalhães said.

"There's a lot of naive poultry populations out there, and this gives a lot of opportunities for these new emerging viruses to really be devastating.

"Everyone is expecting a big resurgence in the next few years."

abc.net.au, 23 November 2021

https://www.abc.net.au

Shipping online surged during Covid. Now the environmental costs are becoming clearer.

2021-11-18

As millions of Americans hunkered at home during Covid lockdowns, the internet became more than a way to do their jobs or pass the time — it became a central way they shopped for goods like groceries, hot meals, furniture and clothing.

The pandemic, in effect, hit overdrive on a decadeslong shift toward online shopping. E-commerce sales jumped nearly 32 percent in 2020 compared to the prior year, according to U.S. Census Bureau data. So far this year, online sales are on track to outpace that record. To meet the demand, delivery companies such as Amazon, FedEx, UPS and food delivery services wrapped millions of purchases in layers of cardboard and plastic and hired thousands of new drivers to bring them to our doorsteps.

Now, cities, climate scientists and companies are trying to figure out the consequences for the planet.

The answer isn't clear-cut. Consumers drove fewer miles to and from stores, while delivery companies drove more — so what was the net effect on greenhouse gas emissions? Offices and restaurants generated less waste, but all that food and packaging delivered to homes added to trash pickups from residential neighborhoods. Which is worse for landfills? And does it even matter, when overall we are consuming more than ever before?

E-commerce sales jumped nearly 32 percent in 2020 compared to the prior year, according to U.S. Census Bureau data.

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"People have been asking this question since the Internet was invented," said Scot Case, vice president of corporate social responsibility and sustainability at the National Retail Federation. "But it probably isn't helpful, because e-commerce is happening, period, and people are shopping online, in-store or some hybrid of the two. So, I think the real question is, how do we make all of those options as sustainable as possible?"

In the decade or so prior to Covid, fewer than 10 academic studies explored whether e-commerce or in-person shopping is better for the environment. In general, the studies that were done found that online shopping produced fewer carbon dioxide emissions than traditional brick-and-mortar retail.

However, few accounted for the enormous variability in those supply chains, from consumer behavior to logistics to waste. For instance, whether an in-store shopper bought one or multiple items affects the climate calculations. So does the type and amount of packaging, along with whether those items were later returned. The distance to and from stores and distribution hubs is key, as is the mode of transportation: A gas-powered vehicle, a bike, or an electric car? What if that electric car was powered by a grid running on fossil fuels? What is the different impact of heating and cooling stores and warehouses?

These questions became more urgent during Covid as people shopped more and, perhaps paradoxically, became more concerned about sustainability.

The most recent research is starting to incorporate more of the complexities of retail. In January, MIT's Real Estate Innovation Lab published a study that simulated hundreds of thousands of those kinds of scenarios and found online shopping to be more sustainable than traditional retail 75 percent of the time.

But consumers today aren't choosing one or the other, underscoring just how tricky this assessment is. So the MIT researchers recommended how shoppers and policymakers could instead help reduce carbon footprints at various steps of the supply chain, because either way, people are buying more.

"This is so much more complicated than, 'E-commerce is better than brick and mortar,'" said Andrea Chegut, director of the lab. "We're not on a good trajectory, because everyone is using both strategies. So on the aggregate, there will be more emissions."

However theoretical it might seem, the question of the environmental impact of shopping has real consequences. The entire supply chain of everything we consume — from the extraction and processing of natural resources into products that are shipped to us and then used and disposed of — accounts for half of global emissions, according to the United Nations. The U.N. also estimates that global material use could double in the coming decades.

Brands and retailers are at the nexus of those supply chains. And only recently have major companies started mapping the entire carbon footprint of their sprawling networks, identifying sources of emissions and setting goals to reduce them. For many, third-party suppliers and customers account for the majority of their climate pie.

There are millions of retailers in the U.S. Of those, nearly 40 top companies have either set science-based targets to slash their total carbon footprints in alignment with the Paris agreement, or pledged to do so, the National Retail Federation found. Those retailers include Amazon, H&M, Ikea and Walmart.

At first blush, it appears that there are three key areas where e-commerce and traditional retail diverge: the last mile (whether a product was delivered or a consumer made a trip to buy it), the buildings (storefronts or warehouses) and the packaging waste.

Most research suggests that ordering goods for delivery is more beneficial for the environment because it means people are making fewer individual shopping trips. The average U.S. consumer goes to the grocery store at least 300 times a year. If they drove there, it was likely in a gas-powered vehicle. Plus, there tends to be higher energy demands at storefronts compared to warehouses.

But that scale "could easily tip in the other direction," according to a study of the U.S. market published last spring by the sustainable investment firm Generation. The firm's researchers found that e-commerce is 17 percent more carbon efficient than traditional retail, but could change with a few tweaks to their assumptions, such as the number of items purchased in a single visit, the amount of packaging and the efficiency of last-mile delivery.

In January, the World Economic Forum also found that growing demand for delivery could spike emissions and traffic congestion by more than 30

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percent in the world's top 100 cities by the end of the decade. The report accounted for the emissions saved from fewer individual shopping trips but didn't consider packaging, and recommended that companies switch to electric vehicles, consolidate hubs for packages and boost nighttime deliveries.

But increasingly, the lines between online and in-store are getting blurred.

A lot of e-commerce growth is within the "omni-chain," the supply chain shared by both in-store and online components, said Mark Mathews, NRF's vice president of research development and industry analysis. Retailers are selling products via multiple channels, and consumers are using all of them — items bought online can be delivered to doorsteps or to a physical store for pickup. Americans might return it online or bring it back to the store. The way companies report that data makes it difficult to parse what is truly online and what is blended, Matthews added. He also noted that the second quarter of 2021 marked the first-time brick and mortar sales grew faster than online in decades.

It might be why climate advocates have focused less on the impacts of online shopping, and more on decarbonizing specific industries in the supply chain.

"It's not really about which one is better, because both have pluses and minuses," Boma Brown-West, director of consumer health at the Environmental Defense Fund, said. "We've seen momentum from companies, but I do think there is more to do in terms of turning sustainability commitments into real results."

In the United States, no retailer is more synonymous with online shopping and delivery than Amazon, which argues for the environmental benefits of online shopping. In an email, Amazon spokesperson Luis Davila pointed to findings by company scientists that suggest online shopping produces fewer emissions than driving to shop at a store; for instance, the company estimates that a single delivery van trip can take 100 round-trip car journeys off the road, on average. During the pandemic, customers made fewer trips to Whole Foods Market stores and other brick-and-mortar Amazon locations and shifted to home delivery, which also lowered emissions.

But take a step back, and a bigger, more complex picture emerges.

From 2019 to 2020, Amazon's U.S. sales jumped 36 percent to $263.5 billion. By the company's own account, its overall emissions spiked 19 percent, equivalent to running 15 coal plants for one year. More fossil fuel use and investments in buildings, data servers and transportation were key drivers.

That figure reflects its response to consumer demand during Covid-19, but doesn't capture progress Amazon made, Davila said. He said the company tracks the amount of carbon per dollar of gross merchandise sales — a concept known as carbon intensity — and by that measure, Amazon decreased the amount of carbon per purchase last year by 16 percent. In a blog post in June, a company scientist argued that this metric allows high-growth companies like Amazon to identify efficiencies.

Amazon also reduced emissions from the electricity it bought by 4 percent due to new investments in clean energy, despite expanding its buildings' square footage. The company is about two-thirds of the way toward 100 percent renewable energy — a key pillar of the company's plan to reach net-zero emissions by 2040.

Emissions from deliveries are expected to decrease as Amazon deploys 100,000 electric vans in the coming decade. Davila did not disclose what portion of the company's fleet that accounts for today.

Big-name retailers such as Target with storefronts across America also are aiming for net-zero emissions by 2040. Target, which has an annual carbon footprint slightly larger than Amazon's, had an overall increase in previous years driven by rising sales.

While Target has slashed emissions from its own operations and reduced the electricity it buys by 26 percent since 2017, that was not enough to offset the increase from activities in its supply chain — like transportation and consumer use of the products it sells — which jumped 16.5 percent.

To address that, a Target spokesperson said the company remains committed to net-zero emissions. To that end, the retailer is pushing for 80 percent of its suppliers to set their own science-based climate goals by 2023, and is making progress toward its goal of slashing emissions from its own buildings and vehicles in half this decade.

These calculations are top of mind for officials in cities like Santa Monica, Calif., who are concerned about the impact of last-mile deliveries on the environment and public health. There isn't hard data on that, but Ariana

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Vito, the city's sustainability analyst, said anecdotally she's seen traffic congestion increase, especially during the pandemic.

Southern California is home to the country's two largest ports. Moving goods is responsible for half of the region's nitrogen oxide pollution and nearly 11 percent of particulate matter, according to government data. Both are precursors to the formation of greenhouse gases, and long-term exposure can cause the kind of respiratory problems that left so many Americans more vulnerable to Covid-19.

As of October, those ports are running 24/7 to ease supply chain bottlenecks. Companies including FedEx, UPS and Walmart expanded night shifts to get more goods on the road.

Months before, Santa Monica launched the country's first zero-emissions delivery zone spanning one-square mile of its downtown, where electric delivery vehicles get priority at certain loading zones. They also are testing last-mile deliveries on e-cargo bikes and scooters.

The initiative, in partnership with the Los Angeles Cleantech Incubator, is in the early stages of measuring the effect on emissions, congestion and delivery efficiency. The goal is to expand it to other cities in Southern California before the 2028 Olympics.

"E-commerce is increasing emissions. There is no doubt about it," said Matt Petersen, CEO of the Cleantech incubator. "It's no longer just FedEx, UPS and the Postal Service on the road coming once a day. There are multiple deliveries to the same address every day for anything you can imagine."

The growing number of deliveries arriving in cardboard boxes, plastic bags and other packaging has raised an alarm that online shopping leads to more waste, like the garbage patches floating in the world's oceans.

Chegut, the director of MIT's Real Estate Innovation Lab, said one of the most striking findings from her team's research concerned packaging; they found that cardboard boxes accounted for some of the largest carbon pollutants in the system regardless of the method of delivery. Removing layers of packaging, changing boxes or even removing them altogether could slash carbon emissions by up to 36 percent, the report found.

The packaging problem is exacerbated by the fact that America's waste infrastructure is ill-equipped to handle all these materials. Most food and packaging ends up in a landfill or is burned to produce energy, generating

105.5 million metric tons of carbon dioxide last year, according to federal data. These facilities are often located in marginalized communities disproportionately exposed to the pollution that incineration creates.

By some estimates, the U.S. may have produced less waste in 2020 because of shutdowns on the commercial and industrial side, from office buildings and restaurants to manufacturers. Those sectors are rebounding, however.

Waste Management, the largest trash and recycling hauler in North America, has more than 4,000 contracts with municipalities across the country and recently reported that it collected fewer tons of waste last year. The company said only about 13.5 percent of it was recycled — a slight boost over the previous year in part because Waste Management has recently invested in recycling facilities.

Brent Bell, the company's vice president of recycling, said the online shopping craze during the pandemic generated the most amount of cardboard he'd ever seen. There were a lot more bottles and cans and plastic films and takeout containers, too.

While paper and cardboard are recycled at the highest rate of any materials nationwide — 68 percent — plastic is at the opposite end of the spectrum. Only about 9 percent of it is recycled, according to federal data. That's because flexible plastic films and pouches and many take out containers still aren't recyclable. Neither are plastic bags, unless consumers bring them to the grocery store. Only then can Waste Management bail them up and sell them to be made into new bags.

Local officials from Baltimore to Minneapolis told POLITICO they saw similar trends last year.

Covid overtaxed Baltimore's sanitation system. By August of 2020, the city's waste haulers were overworked, falling ill with Covid, and trash was piling up in neighborhoods across the city. Officials halted curbside recycling for six months so truck drivers could focus on trash collection; most of that recycling instead ended up in landfills or was incinerated.

The city got its curbside recycling up and running again in January and hopes a new $9 million investment in new blue recycling carts will boost recycling rates.

In Minneapolis, local processor Eureka Recycling handled 35 percent more aluminum, nearly 24 percent more cardboard and 13 percent more plastic in fiscal 2020 compared to the previous year, according to internal data.

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"E-commerce has definitely led to more packaging," said Kate Davenport, co-president of Eureka.

On the bright side, companies including Amazon, PepsiCo, Coca Cola and Target have made promises to buy more recycled materials to use in packaging in the coming years and reduce the amount of material they use, such as virgin plastic, Davenport said.

Amazon's Davila said the company is working on using as little material as possible, in part by investing in technology that custom-sizes boxes to products so it can eliminate single-use plastic padding.

These are steps in the right direction, but still not enough to create a circular waste stream that eases the strain on natural resources, Davenport said. That will take new public policy.

Eureka and other environmental groups advocate for a policy known as "extended producer responsibility," which puts companies — rather than taxpayers — on the hook for the costs of cleaning up the packaging and other waste their products create. Maine and Washington enacted laws this summer and at least 10 other states are considering them.

After longtime opposition to extended producer responsibility, business groups such as Ameripen, which represents packaging makers, and the American Beverage Association had a change of heart earlier this year. In order for member companies to achieve their own sustainability goals, they need access to more recycled commodities. That means making sure more of their own products get recycled.

The revenue from the laws could be reinvested into local recycling systems to help process more plastic and other materials. An estimated $17 billion investment over five years is needed to boost recycling rates to at least 70 percent, according to May analysis by The Recycling Partnership.

To date, companies have invested a small fraction of that.

At the end of the day, global consumerism has had the single-largest environmental impact of any human activity and no one actor alone will solve the problem, said Brown-West of the Environmental Defense Fund.

Companies can make a big dent by improving the sustainability of their products and using their enormous influence over supply chains to help decarbonize the energy, transportation and building sectors. They also should support new climate policy, Brown-West said.

Consumers also have more power than they may realize, said Chegut of MIT.

In study after study, taking fewer trips to the store, bundling purchases and avoiding returns can all make an impact. Just owning an electric vehicle isn't a silver bullet.

"We learned that, if you own a Tesla in major coal energy states, that's almost as bad as going to the supermarket every day," Chegut said. "So, my biggest takeaway is to be a more mindful consumer. Try not to get in the car to go shop. If you do, make it a big shopping trip to avoid multiple trips. Walking and biking always wins."

And then there's simplest solution, regardless of whether we shop online or in person: "We could also buy less," she said.

politico.com, 18 November 2021

https://www.politico.com

A new map shows where carbon needs to stay in nature to avoid climate disaster

2021-11-18

Over decades, centuries and millennia, the steady skyward climb of redwoods, the tangled march of mangroves along tropical coasts and the slow submersion of carbon-rich soil in peatlands has locked away billions of tons of carbon.

If these natural vaults get busted open, through deforestation or dredging of swamplands, it would take centuries before those redwoods or mangroves could grow back to their former fullness and reclaim all that carbon. Such carbon is "irrecoverable" on the timescale — decades, not centuries — needed to avoid the worst impacts of climate change, and keeping it locked away is crucial.

Now, through a new mapping project, scientists have estimated how much irrecoverable carbon resides in peatlands, mangroves, forests and elsewhere around the globe — and which areas need protection.

The new estimate puts the total amount of irrecoverable carbon at 139 gigatons, researchers report November 18 in Nature Sustainability. That's equivalent to about 15 years of human carbon dioxide emissions at current levels. And if all that carbon were released, it's almost certainly

The new estimate puts the total amount of irrecoverable carbon at 139 gigatons, researchers report November 18 in Nature Sustainability.

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enough to push the planet past 1.5 degrees Celsius of warming above preindustrial levels.

"This is the carbon we must protect to avert climate catastrophe," says Monica Noon, an environmental data scientist at Conservation International in Arlington, Va. Current efforts to keep global warming below the ambitious target of 1.5 degrees C require that we reach net-zero emissions by 2050, and that carbon stored in nature stays put (SN:12/17/18). But agriculture and other development pressures threaten some of these carbon stores.

To map this at-risk carbon, Noon and her colleagues combined satellite data with estimates of how much total carbon is stored in ecosystems vulnerable to human incursion. The researchers excluded areas like permafrost, which stores lots of carbon but isn't likely to be developed (although it's thawing due to warming), as well as tree plantations, which have already been altered (SN: 9/25/19). The researchers then calculated how much carbon would get released from land conversions, such as clearing a forest for farmland.

That land might store varying amounts of carbon, depending on whether it becomes a palm oil plantation or a parking lot. To simplify, the researchers assumed cleared land was left alone, with saplings free to grow where giants once stood. That allowed the researchers to estimate how long it might take for the released carbon to be reintegrated into the land. Much of that carbon would remain in the air by 2050, the team reports, as many of these ecosystems take centuries to return to their former glory, rendering it irrecoverable on a timescale that matters for addressing climate change.

Releasing that 139 gigatons of irrecoverable carbon could have irrevocable consequences. For comparison, the United Nations' Intergovernmental Panel on Climate Change estimates that humans can emit only 109 more gigatons of carbon to have a two-thirds chance of keeping global warming below 1.5 degrees C. "These are the places we absolutely have to protect," Noon says.

Approximately half of this irrecoverable carbon sits on just 3.3 percent of Earth's total land area, equivalent to roughly the area of India and Mexico combined. Key areas are in the Amazon, the Pacific Northwest, and the tropical forests and mangroves of Borneo. "The fact that it's so concentrated means we can protect it," Noon says.

Roughly half of irrecoverable carbon already falls within existing protected areas or lands managed by Indigenous peoples. Adding an additional 8 million square kilometers of protected area, which is only about 5.4 percent of the planet's land surface, would bring 75 percent of this carbon under some form of protection, Noon says.

"It's really important to have spatially explicit maps of where these irrecoverable carbon stocks are," says Kate Dooley, a geographer at the University of Melbourne in Australia who wasn't involved in the study. "It's a small percentage globally, but it's still a lot of land." Many of these dense stores are in places at high risk of development, she says.

"It's so hard to stop this drive of deforestation," she says, but these maps will help focus the efforts of governments, civil society groups and academics on the places that matter most for the climate.

sciencenews.org, 18 November 2021

https://www.sciencenews.org

Where is the water going?

2021-11-22

Farmers in the heart of California's agricultural belt – Kings County – sense something is awry with their water supplies. In this intensively farmed, perennially dry county, water is leaving at a concerning rate.

"We've all seen it," said walnut farmer Steve Walker. "We haven't sat down and put dye in the water to watch where it actually goes. But everybody talks about it, and we're all concerned."

Some farmers can't afford to do either, making the difficult decision to get out of agriculture all together.

As far as Walker knows, no agency, city or county board is trying to figure out what's really happening.

"There's so many canals and ways it can move; it's hard to track," he said. But this much he knows — certain groundwater wells in the county are running practically year round, even in wet years.

"So, it's going somewhere," Walker said. "And that's the biggest issue. Because once it's pumped out, we aren't getting it back."

Now, in the grip of yet another devastating drought, Kings County farmers like Walker want to know: Where is the water going?

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For the portions that can be tracked through state and other water district records, the water is mostly flowing south to Kern County, much of it from Kings County's two largest and most powerful farming operations — J.G. Boswell Company and Sandridge Partners.

Exactly how much is moving and who is benefitting from it are more murky questions, as water – especially river and groundwater – in California is notoriously hard to track. What is clear is that over the past 12 years, Boswell and Sandridge have moved a combined 239,000 acre feet of State Water Project water out of Kings County — all with approval from the state's Department of Water Resources (DWR).

Some of that state contracted water appears to have been used in multi-million dollar deals by Boswell, based on the few records that could be tracked, and some has gone to Sandridge's own fields in other counties, according to the company's owner.

The end result, though, is less water staying in Kings County. And the consequences of this could be far reaching. Less surface water forces growers to pay for deeper wells or additional water supplies — particularly expensive during one of the worst droughts in recent state history.

Some farmers can't afford to do either, making the difficult decision to get out of agriculture all together. "Independent farmers are selling out," said Kings County farmer Robert Smith, who grows walnuts, almonds, corn and cotton on about 1,000 acres. "I'm a small guy over here and the big-time guys, well I thought they were big at 10,000 acres, even they're selling out."

Smith, Walker and others fear that if large amounts of water continue to move out of Kings — with little to no oversight from the state — most smaller farmers will be driven out of a part of California they have called home for generations.

"It just doesn't look very good for us right now," Smith said.

KINGS FARMERS

Kings County is small by San Joaquin Valley standards — only 1,392 square miles, or just about the size of Rhode Island. By comparison, its closest neighbors, Kern, Fresno and Tulare sit at 8,000, 6,000 and 4,800 square miles, respectively. Like its neighbors, Kings is intensively farmed. About 90% of its farms are considered "family owned," according to the 2017 US Department of Agriculture farm census.

"We haven't sat down and put dye in the water to watch where it actually goes. But everybody talks about it, and we're all concerned."

Farming runs deep in the blood of growers like Jeff and Karen Gilcrease. The Gilcrease family has been growing crops in Kings County since the 1880s. They have the original 1881 homestead certificate signed by a secretary in the James Garfield administration for 80 acres southeast of Lemoore, where they still live and farm.

Over the years, the farm has truly been a family operation — with Karen keeping the books and their children helping to bring in the harvests. Though the Gilcreases expanded to 700 acres at one point, they had to sell off part of their land because they didn't have the water to keep farming it. They get some water from the Kings River but rely mostly on groundwater.

Jeff has been involved in the groundwater sustainability planning in his area and is concerned about the out-of-county water transfers he's heard about. "It's not good in the long term," he said. A strong, diverse farming sector is vital to the local economy and food security — and it requires water.

"It might be legal, but it's not moral," Karen said of water leaving Kings.

Karen isn't the only one who feels this way.

David Avila is a talkative 75-year-old of Portuguese ancestry whose family first came to California in the 1840s and has been farming in the Hanford area since around 1900. Avila, along with his wife and children, grows nearly 100 varieties of fruit trees on multiple small plots of land and sells the produce at dozens of farmers markets from Beverly Hills to San Luis Obispo.

He and his son know their land so well they can point out which areas retain more water in which seasons and the direction the water moves underground.

"Work with nature; don't fight it," Avila said repeatedly. But that's become increasingly challenging.

He recalls that when he was growing up, the region was dotted with small dairies, orchards, rotating crops of corn, cotton and alfalfa, and open grazing land with sloughs that could absorb water in flood years. Now the land is covered with huge almond and pistachio orchards, permanent crops which account for more than 66,000 acres of Kings' total 782,731 harvested acres, according to county crop reports.

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Avila says corporations are gobbling up the land to plant more permanent crops and draining the county's water in the process. "Water is our blood," he said, and "they're stealing it."

Water is a key variable smaller farmers have little to no control over. Bigger landowners hold contracts for most of the state water brought to Kings from the Sacramento-San Joaquin Delta, and they own large portions of the private ditch companies that divvy up the Kings River water and ferry it to farms.

That leaves smaller farmers with mostly groundwater, which Walker said has dropped 100 feet to 120 feet just this year. That's partly due to drought but also greater use. Kings County approved 1,238 new agricultural well permits between the start of the last drought in 2012 and 2021, according to county records.

"When you have a bowl and only three straws, it takes longer to empty," Walker said. "You put 20 straws in it, it don't take very long."

Meanwhile, Smith hopes his young children will one day take his place on the tractor. But he fears family ownership is already being priced out of farming and predicts the business will be consolidated into fewer and fewer hands.

The data show that's already happening. From 2002 to 2017, the most recent USDA farm census, the number of farms in Kings County declined 16.6%. But the size of farms increased 14.5% from an average 559 acres to 640 acres.

"The corporations and the bigger guys are buying up land left and right for astronomical prices," Smith said. "Anything that has water on it, you're going to contend with big money." That includes land with river rights, state water contracts or even just groundwater.

"My dad said it from day one, he'd rather own all the water than all the gold in the ground," Smith said.

THE WATER TITANS

Boswell and Sandridge are the two biggest kids on the block when it comes to farming and water in Kings County.

Boswell has been woven into the fabric of Kings County since its founder, James Griffin Boswell, first set foot on the old Tulare Lake bed 100 years ago and envisioned a cotton empire. His nephew spun the company into a $2.5 billion international farming and development powerhouse. It

now retains about 132,000 acres in Kings – as well as 3,700 acres in Tulare County and 23,000 acres in Kern County, according to ParcelQuest, a property information database.

Boswell has employed generations of Kings County families, mostly in the small town of Corcoran where a high school stadium and park bear the Boswell name. And the company maintains positions on just about every ag and water related board and commission in Kings, giving it considerable political heft.

The company is run from its Pasadena offices by James W. Boswell, chairman, CEO and great-nephew of the founder. For all its influence and power, Boswell is notoriously tight-lipped, its principals and employees are rarely quoted in the media. Boswell repeatedly declined requests for interviews on this story.

In contrast, John Vidovich, who helms Sandridge, comes from a Silicon Valley farming-turned-developer family. He bought his first Kings County property in a foreclosure in 1994 and eventually amassed 102,000 acres in Kings – as well as nearly 40,000 acres in Kern County, 10,000 in Tulare County and 1,700 in Fresno County, according to ParcelQuest.

Vidovich made headlines – and a lot of enemies – in 2009 by permanently selling rights to 14,000 acre feet of state water from a Kings County water district to southern California for $73 million, according to media reports. The sale is still considered a blow to Kings' water portfolio by other farmers. And Vidovich has said if he had to do it over, he wouldn't make that sale.

His pumping and movement of groundwater out of its home district has also landed him in a dubious spotlight, according to media reports. In 2017, he made news again for his part in a plan to take Kings River flood water out of the county — an effort that's still ongoing. Though he insists this flood water isn't being used and is, in fact, a nuisance, locals consider it an attempted theft of the Kings River.

Vidovich participates on several local water boards, even serving as chair on one. Though he doesn't seek out media attention, when asked about water under his control, he rarely refuses to talk. He often points out that water districts, which oversee water allocations and maintain infrastructure, are public entities, and the public has a right to information, as he told SJV Water in an interview for this story.

WATER FIGHTS

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Though Boswell and Vidovich both have access to large shares of water, their relationship over this precious resource is downright antagonistic. They are now the driving forces behind two major legal battles over Kings River water.

In one battle, the Kings River Water Association, where Boswell is a major rights holder, is suing Tulare Lake Reclamation District 761 and Sandridge Partners, run by Vidovich, for shipping its Kings River water to lands it owns in western Kings County. The association contends that even though those lands are in the county, they are beyond what's considered the river's "service area." And river water cannot be taken outside that service area, according to the lawsuit.

The case is being heard in Kern County by Judge David Lampe. The judge made a partial ruling in June that long standing river agreements do allow river owners to move water within the service area. The boundaries of that service area, however, have yet to be determined. A trial date has been set for December 2022.

Boswell and Vidovich also find themselves on opposite sides of whether the Kings River is being fully utilized by all of its rights holders. If the State Water Resources Control Board determines that the Kings River Water Association isn't fully using its water rights, it could give those rights away.

The sprawling Semitropic Water Storage District in Kern County wants Kings River flood water that it says current rights holders are letting flow to the ocean in heavy precipitation years. The district plans to store flood flows on land next to the California Aqueduct, the main artery that moves water from northern to southern California, then pump it south. Vidovich owns that land, and Semitropic has already paid him $40 million for an easement. Vidovich would also get a cut of the floodwater and be allowed to use the facilities to move some groundwater, per the project contract.

The Kings River Water Association, including the Tulare Lake Basin Water Storage District, where Boswell is the majority landowner, are fighting the plan tooth and nail. According to legal briefs filed by Tulare Lake, all the floodwater that can be put to beneficial use has been, and there's no leftover water available for Semitropic. The Water Board began holding hearings on the issue this past summer.

The companies are also at odds over groundwater.

In a letter to the state last summer, Boswell's vice president – attorney Jeof Wyrick – who chairs the El Rico Groundwater Sustainability Agency,

accused Vidovich of moving groundwater out of the area via pipeline where it cannot be tracked. He demanded Sandridge provide more data to the other groundwater sustainability agencies.

"There is some uncertainty by El Rico GSA with regard to this request because of the hidden nature of Sandridge's operations," Wyrick wrote in the June 2020 letter.

In an interview, Vidovich denied sending groundwater out of Kings County. "Not one acre foot," he insisted.

When asked about the pipeline Wyrick mentions in his June 2020 letter, Vidovich says only floodwater from the Kings River may have been shipped out of the county.

Vidovich freely acknowledges that he's moving some surface state water out of Kings County. But that's water from the Sacramento-San Joaquin Delta, not native Kings County water. "I'm all for moving water around," he said. "We amalgamate our water to use on our most productive land." Over the past 12 years, he's moved about 137,000 acre feet of his state water from Kings County south to nut orchards he owns on the west side of Kern, according to state and other water district records.

Boswell has also been moving water out of Kings. Since 2009, the company has transferred or sold 102,000 acre feet of its surface water out of the county, according to records from DWR, Tulare Lake Basin Storage District and the Kern County water agency. The difference, according to Vidovich, is Sandridge is letting some of its Kings County lands go fallow, while, he says, Boswell is pumping additional groundwater to continue farming its Kings County acreage.

It's unclear if Boswell is selling surface water on a regular basis, but according to invoices obtained by SJV Water, the company did sell 49,000 acre feet of its Kings River water out of the county for $47.5 million in 2015 and 2016 and another 35,000 acre feet of river water for an undisclosed amount in 2019.

"It's really, really not cool," Vidovich said.

Boswell has refused requests to answer questions about the company's water moves – including how much it pumps. That information also isn't contained in groundwater plans for the El Rico Groundwater Sustainability Agency, which covers Boswell lands almost exclusively.

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However, during testimony in the state's Kings River proceeding, Boswell employee Mark Unruh said the company irrigates nearly year-round, from late October through the summer. It has 61 wells capable of pumping a combined 240 cubic feet per second. At the upper limit of 300 days per year, that could mean Boswell is pumping up to 140,000 acre feet a year.

RIGHT OR WRONG

Whether the water is leaving Kings County for cash payments or to grow crops that will eventually be sold for profit, it's all the same thing, said economist David Zetland, who lectures on the politics and economics of water at Leiden University College in the Netherlands.

"Are they in the wrong for moving water? Legally? No," he said. "But in terms of equity, yes, there is a problem."

Exporting large amounts of water from one farm region to another and aggressively pumping groundwater both negatively affect other landowners. Less surface water creates a greater need to pump from underground, which lowers the water table for all users. As water drops, growers engage in a well-digging arms race.

"From that perspective, it becomes massively economically inefficient," said Zetland. Digging a new well can cost tens of thousands of dollars, and as each farmer chases water deeper into the earth, it not only pushes others to go deeper, it undermines expensive efforts to recharge the aquifer.

For example, Westlands Water District, which borders Kings County, plans to gather water in heavy rainfall years and inject it into the aquifer to safeguard water levels. But "it's difficult when right next door they're dropping [water levels] 60 to 100 feet," Russ Freeman, Westlands' Deputy General Manager for water resources, said in a previous SJV Water article.

Those are just some of the indirect costs attached to moving large amounts of water out of a region, Zetland said. The cost to society of pushing out smaller farmers is harder to calculate.

"If the little guys disappear, we lose business diversity and expertise," Zetland said. "We lose entrepreneurs. We lose innovation."

Still, Zetland didn't fault Sandridge or Boswell. "This is what businesses do," he said. "The state of California is at fault. They set the ground rules, and once the rules are set, people play the game."

OVERSIGHT OVERLOOKED

Doug Verboon, a Kings County farmer and member of the county board of supervisors, sounds weary when he talks about Kings County's water.

"People complain all the time about what's happening with our water, but no one wants to do anything," he said. He tried to get the county to pass an ordinance barring the export of native groundwater but said he could not get enough votes. When he brought the issue to the Kings County Water Commission in February 2020, it was tabled and the commission has not met since.

In the meantime, Boswell and Vidovich have brought their concerns to California's DWR, which oversees transfers involving state water. It is also tasked with reviewing groundwater plans under the state's Sustainable Groundwater Management Act (SGMA), passed in 2014.

That act requires groundwater agencies in areas with critically over drafted water basins to draw up plans to bring aquifers into balance by 2040, meaning more water shouldn't be pumped out than goes back in. The entire San Joaquin Valley, including Kings County, is critically over drafted.

Water Resources Director Karla Nemeth acknowledged she had met with representatives of groundwater agencies regarding allegations that Boswell is aggressively pumping its Kings County lands, because it's selling off its state water. But, she said, her department can't really step in until it has reviewed groundwater plans submitted to the state in 2020.

"In terms of special enforcement to shut things down, that's not what SGMA provides to the department," she said. The agency's role is simply to review groundwater plans to see if they're adequate. If the plans are rejected and local groundwater agencies refuse to make corrections, the state can refer the issue to the Water Resources Control Board, which could set pumping limits and issue fines — but only after a lengthy process.

That said, she explained the department would be looking closely at groundwater pumping and water transfers from Kings County, because it appears "this is a hot spot where the math doesn't work."

"If we had water transfers that we know don't mesh with an approved groundwater sustainability plan, that's going to be a problem for DWR's continued approval of those transfers," Nemeth said, adding that the department will be reevaluating its transfer program to add greater oversight and transparency.

"PUMPING AND PUMPING"

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Many Kings County farmers, who have watched water leaving their region, wonder if it's being sold to Los Angeles. The city's political clout, money and history of reaching north to quench its thirst make it an obvious water bogeyman to growers in the San Joaquin Valley. However, state and water district records indicate the Boswell and Sandridge water is largely staying in the valley.

Though he did sell a chunk of water rights to southern California in 2009, Vidovich scoffed at the idea that he's currently selling water to the southland. "No, no, I'm not selling water to LA," he said. "It doesn't make economic sense. And if it's not economical, you don't have to question the morality."

Ultimately, he said, even if Boswell and Sandridge did move all their state water out of Kings County, it's a fairly minor loss to the county. Combined, the two companies control close to 90,000 acre feet of the total 140,600 acre feet of contracted state water. But those numbers reflect full contracted allocations. The State Water Project rarely delivers full allocations and, in fact, only delivered 5% of contracted water during this past drought year.

"It's a decimal point," Vidovich said of state water amounts compared to what farmers use from rivers and groundwater.

And that may be true. A 2020 groundwater sustainability report shows that over the previous five years, agriculture in Kings County relied on an average of about 319,000 acre feet from local rivers and streams, 475,000 acre feet from groundwater and just 37,000 acre feet of state water. However, Vidovich's comments do not address whether all the river and groundwater is being used in Kings County or sent elsewhere — a question that has become nearly impossible to answer.

Though Vidovich didn't feel state water movement would substantially impact Kings County farming, he still predicted farming will shrink there. That's true of the entire San Joaquin Valley, where he said farming's footprint is retracting because of pumping restrictions looming under the state's new groundwater law.

For his part, Vidovich is ready for the water pinch. His strategy has always been to use about 30% of his land for farming and 70% for its water.

"We're preparing for SGMA. Everyone else is just pumping and pumping," he said.

That's fine for a farming operation the size of Sandridge or Boswell, but smaller growers can't afford to let that much ground go unplanted.

"The little guy is gone," said Walker, the walnut farmer. "I've seen a lot of people come and go out here. But, in the last five or 10 years, only corporate guys have been coming in. Everyone else is leaving."

circleofblue.org, 22 November 2021

https://www.circleofblue.org

This eco-friendly glitter gets its color from plants, not plastic

2021-11-18

All that glitters is not green. Glitter and shimmery pigments are often made using toxic compounds or pollutive microplastics (SN: 4/15/19). That makes the sparkly stuff, notoriously difficult to clean up in the house, a scourge on the environment too.

A new, nontoxic, biodegradable alternative could change that. In the material, cellulose — the main building block of plant cell walls — creates nanoscale patterns that give rise to vibrant structural colors (SN: 9/28/21). Such a material could be used to make eco-friendly glitter and shiny pigments for paints, cosmetics or packaging, researchers report November 11 in Nature Materials.

A new, nontoxic, biodegradable alternative could change that.

The inspiration to harness cellulose came from the African plant Pollia condensata, which produces bright, iridescent blue fruits called marble berries. Tiny patterns of cellulose fibers in the berries' cell walls reflect specific wavelengths of light to create the signature hue. "I thought, if the plants can make it, we should be able to make it," says chemist Silvia Vignolini of the University of Cambridge.

Vignolini and colleagues whipped up a watery mixture containing cellulose fibers and poured it onto plastic. As the liquid dried into a film, the rodlike fibers settled into helical structures resembling spiral staircases. Tweaking factors such as the steepness of those staircases changed which wavelengths of light the cellulose arrangements reflected, and therefore the color of the film.

That allowed the researchers, like fairy-tale characters spinning straw into gold, to transform their clear, plant-based slurry into meter-long shimmery ribbons in a rainbow of colors. These swaths could then be peeled off their plastic platform and ground up to make glitter.

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"You can use any type of cellulose," Vignolini says. Her team used cellulose from wood pulp, but could have used fruit peels or cotton fibers left over from textile production.

The researchers need to test the environmental impacts of their newfangled glitter. But Vignolini is optimistic that materials using such natural ingredients have a bright future.

sciencenews.org, 18 November 2021

https://www.sciencenews.org

Why 'I've rented my dress' could soon be the most fashionable thing to say

2021-11-21

When planning her outfit for an upcoming awards ceremony, Lily Murphy was wary of two things – how much she spent on clothes and the impact on the environment. The solution was to rent a dress from someone who had the style and fit she wanted.

The solution was to rent a dress from someone who had the style and fit she wanted.

"I have become really aware of my over-consumption of fashion over the years," says the 26-year-old PR manager. "I have also become aware of how much money I have spent on clothes, and how frequently I wear a new outfit and then lose interest in ever wearing it again. I think this is typical of young women, especially when you buy something with one event in mind."

Using an app called Hurr, Murphy rented a dress by London-based designers Rixo to attend her black tie event, paying just under £65 to borrow it for four days.

Renting fashion online is not a new thing – Marks & Spencer last week made a range of womenswear available for rent – but her outfit came from the wardrobe of another woman.

As a younger generation of consumers takes a more sustainable approach to what it wears and also demands to have fresh looks for its social media posts, networks that link buyers and sellers have emerged.

By Rotation, a London-based company, was started in 2019 by Eshita Kabra, who was concerned about the high levels of textile waste she saw during her honeymoon in her native India. Kabra says most of her users are millennials and from "generation Z" – that is, the under-40s.

Users can borrow or lend designer dresses and bags by the day, with the option of the item either being posted or collected. Loans are usually for between three and four days – to take into account the time needed to post the item back. Each side pays a 15% fee and there is an optional fee for cleaning set by the lender.

In one example, a designer dress is listed for rental at £10 a day – £30 for three days – with a £10 cleaning fee, plus the 15% fee for the company which comes to £6, bringing the bill to £46. Dresses can be rented for one day, but the company recommends lenders set three as the minimum, with the dress received on the first day, and returned on the third.

Hurr, which Murphy used, operates in a similar way. Pieces have to be less than two years old and in "excellent condition" according to the company. An algorithm calculates the suggested rental fee, based on the retail price of the piece, and the fees are 15% for both sides. Murphy's bill for four days' rental was broken down into £34.30 for the clothes, a service fee of £5.15, a dry-cleaning charge of £10, shipping of £10 and a damage protection fee of £5, which is optional.

Bought new, the dress would have cost £270, and Murphy says she may not have worn it more than once.

If something is damaged, owners can bill the borrower on By Rotation. If they refuse to pay, the borrower's details can be handed over to the lender for them to pursue the matter in the small claims court, although this has not happened yet, Kabra says.

Hurr founder Victoria Prew says borrowers are asked to pay the market value if an item is damaged beyond repair.

As well as wanting to reduce their carbon footprint, young consumers often want to wear something new to an event – and to update their social media feed.

"They don't just think about the days they are wearing the clothes – they think about the Instagram photo and the moment that will last forever," says one industry figure who works in venture capital.

"She wants the photo in that dress that will stay on her Instagram, and will forever stay in her feed. People are investing for that."

'I have become really aware of how much money I have spent on clothes and how frequently I wear a new outfit and then lose interest'

Lily Murphy

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What you won't find on the new generation of lending apps are high-street brands such as Zara and H&M, where shoppers can buy pieces for the same amount they would pay to rent a high-end piece.

They are, however, to be found on an app called Nuw. Aisling Byrne set it up to try and tackle the problem of vast amounts of waste in the fashion industry, which often end up in the developing world.

In what is described as an "online swap shop", users can upload pictures of their clothes – designer or high street – and earn coins, which can then be exchanged for items that other users put up.

The coins are received when the item is uploaded to the site, with a high street brand earning a silver coin and a designer piece getting a gold coin, which can then be traded. The person receiving the piece pays a 99p fee and postage.

Although there are designer clothes on the site, all of the top 10 sources of items are high street stores, says Byrne.

Renting would not work for casual, cheaper clothes, she says, nor would selling them secondhand as they are already so cheap in the shops. But by taking away the choice of having to put a price on the clothes, there is now a far more efficient way to circulate them to avoid landfill.

"These clothes are still valuable, they are in perfectly good condition and people want them, but they won't buy them secondhand at the same price as they are sold firsthand," she says. Some 22,000 items have been exchanged over the last year.

theguardian.com, 21 November 2021

https://www.theguardian.com

Could climate change make food less nutritious?

2021-11-16

As the climate crisis progresses, the planet is becoming less inhabitable—not only for humans and other animals, but also for plants.

Farmers know first-hand how climate disasters, pollinator loss, heat waves, flash floods, and diminishing water supplies can make growing crops harder and less predictable. Yet many questions remain when it comes to how exactly crops are responding across cultivars and varying landscapes.

"The paper shows very clearly that production will definitely be diminished," said Martin Bloem, the director of the Johns Hopkins Center for a Livable Future and an author on the review.

A new review paper, published in Advances in Nutrition, draws together the existing science of how climate change threatens staple grains, fruits, vegetables, and nuts across the world, while also underscoring the significant need for further research. The team of public health researchers from John Hopkins Bloomberg School of Public Health and the Children's Investment Fund Foundation in London conclude that climate change—including the combined impacts of rising temperature and carbon dioxide, rising sea levels, and climate disasters—will cause crop yields, or the amount of food we can produce on the planet, to fall. The authors project that this could trigger increased spikes in food prices, deepening food insecurity and micronutrient deficiencies.

"The paper shows very clearly that production will definitely be diminished," said Martin Bloem, the director of the Johns Hopkins Center for a Livable Future and an author on the review. The researchers found that foods rich in micronutrients—particularly vitamin A, zinc, and iron—will see decreased yields, especially threatening the staple food and nutrient supply of low- and middle-income countries. While unable to draw more nuanced conclusions, Bloem says "there's enough evidence that we need to [turn to] solutions."

Already, over 2 billion people, or 30 percent of the global population, suffer from micronutrient deficiencies, a major cause of death and disease, and the authors project this will likely worsen.

Richard Semba, the review's lead author and a professor at the School of Public Health, hopes the paper will draw attention to this urgent but often overlooked aspect of the climate crisis.

"We're watching this disaster unfold," he said. "People who work in international health and nutrition need to start pointing out the changes that are going to come with rising temperature, atmospheric carbon dioxide, and sea level rise."

This growing health burden is an environmental justice issue, given that it will not be shouldered equally throughout the world. "The countries that are likely to feel the brunt of this, like with so many of the consequences of climate change, are those in the developing world—those that are already on the brink of nutritional deficiency and rely most heavily on the foods affected by this," said Matthew Smith, a research scientist at the Harvard T.H. Chan School of Public Health. "That's a huge part of the story."

"We're watching this disaster unfold. People who work in international health and nutrition need to start pointing out the changes that are going

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to come with rising temperature, atmospheric carbon dioxide, and sea level rise."

The potential for micronutrient deficiencies comes with far-reaching public health consequences, explains Smith. "Zinc deficiency, especially in children, makes you a lot more susceptible to severe cases or dying from respiratory infections, diarrheal diseases, [and malaria]," said Smith, who wasn't involved in the paper. Iron deficiency, he explained, "can cause anemia, lower IQ and cognitive ability, reduce work capacity, and increase mortality for mothers and their children."

Both iron and zinc are found in legumes, nuts, and grains, which the authors expect will see critical drops in yields. Rice, a staple crop for 3.5 billion people, is increasingly threatened by coastal erosion and rising temperatures. Climate change is predicted to bring major drought to over 60 percent of areas that grow wheat, another important source of nutrition and energy. As the review notes, beans, grown by smallholders in western Malawi, northern Mozambique, Zambia, Zimbabwe, and Tanzania will likely no longer be cultivated in the region by 2050, due to worsening drought.

The review also looked at vitamin A, commonly found in leafy green vegetables and yellow and orange fruit. Like zinc, vitamin A is important for immunity and decreasing the risk of infections; a deficiency can also lead to vision problems, including night blindness. The authors highlight how mangos, an important source of vitamin A, are sensitive to shifts in rainfall and temperature. In some countries, their cultivation is already moving to higher elevations and latitudes, more conducive to their growth and flowering, to adapt to climate change.

The Research Is Just Beginning

While the authors project overall production declines, they provide far from a complete picture of how climate change disrupts crop growth. In researching the paper, Semba says he was surprised by the "considerable lack of standardization" across studies and consistent data needed for more nuanced conclusions. "Luckily, there were enough studies done where you could paint broad strokes," he added.

The authors are hopeful that the review will help serve as a jumping off point for more detailed research. "There are so many gaps," said Bloem. "I do feel that the paper is just the beginning of a whole series of papers, looking at different gaps."

One murky area is the existing body of research on how micronutrient levels within individual plants are affected by rising temperatures and atmospheric carbon dioxide. Many of the studies from the past 30 years were conducted with a technology known as Free-Air Carbon Dioxide Enrichment (FACE), which was developed to study how plants respond to more carbon dioxide in an open-setting under natural conditions and doesn't account for rising average temperatures. But the review also brings in emerging studies that rely on a new technology, known as T-FACE, which combines the existing FACE set-up with infrared heaters to allow scientists to study warmer temperature and carbon dioxide levels at the same time.

Decreases in crop yields will likely be the most significant threat to micronutrient access.

When rising carbon dioxide is studied on its own, the results show that plant growth tends to be stimulated. Yet the review notes that this fast growth often leads to lowered concentrations of micronutrients in the plants. However, when rising temperature and elevated carbon dioxide are looked at together in T-FACE studies, some initial data suggests that the micronutrient levels in individual plants remain high even as yields go down. And that decrease in crop yields, the paper's authors say, will likely be the most significant threat to micronutrient access.

In addition, climate impacts such as extreme weather events are wiping out entire fields, lowering yields, and disrupting the food supply chain, while ground-level ozone pollution (which gets worse when the temperature rises) is already diminishing the growth of staples, like rice, wheat, soybean, and potatoes. Rising oceans are eroding and inundating coastal farm ecosystems. And climate change is one of the factors driving the decline in pollinators, which are essential for many crops.

Experts unaffiliated with the review paper also emphasized that T-FACE technology is still in its infancy with limited data.

"The number of studies that needed to be assembled in order to find a consistent signal for strict FACE experiments was quite a few," said Harvard's Matthew Smith. "If you look at the review's studies, there's [only] a handful that have used T-FACE to find results. But often they're either looking at a single cultivar or under a single growing season."

Based on the recent addition of T-FACE research, Smith is not ready to draw any firm conclusions just yet. However, he considers the study of the combined impacts of carbon dioxide and temperature to be an important

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new direction for the field. "It is important to know how they work in concert," he said.

Lewis Ziska, a plant physiologist and professor at Columbia's Mailman School of Public Health who has extensively studied the impacts of rising carbon dioxide on crops, describes the recent review as a "good primer" on the issue. But he also emphasized the limited body of T-FACE research. Ziska says how micronutrient levels within crops will be impacted by climate change is "an area that needs a lot more work and a deeper dive." He notes that there is other research that suggests that carbon dioxide's main impact on plants will be on their nutritional quality, regardless of temperature for some plants. "That's still an open question," said Ziska.

The review and existing body of research clearly show that rising CO2, often thought of solely as plant food, isn't beneficial to plants in the broader context of the climate crisis. And Ziska believes this misguided notion may partially explain the research gaps.

"This is an issue that does not get any of the attention that it deserves," he said. "When you see carbon dioxide as [only] stimulating the growth of plants, that's a very simplistic meme of what CO2 actually does." Ziska, who left a role at the U.S. Department of Agriculture after the Trump Administration attempted to bury his paper on carbon dioxide's impacts on rice, has been working to bring the full impacts of CO2 to the forefront.

"When you see carbon dioxide as [only] stimulating the growth of plants, that's a very simplistic meme of what CO2 actually does."

For example, Ziska points to grains like wheat and rice, which are described as "self-fruiting." At higher temperatures, that process stops working right due to sterile pollen, which can be worsened by elevated carbon dioxide. By stimulating plant growth, CO2 leads the plant to require more water. To conserve water, the plant will often close its pores, known as the stomata, to prevent evaporation. However, this also makes it harder for the plant to cool itself down, similar to sweating for humans, and can increase the risk of sterile pollen.

This idea that elevated CO2 levels is a net positive for plants has been touted by the fossil fuel industry in climate disinformation campaigns. In a 2000 Exxon advertisement, published in the New York Times, the oil and gas company argues that climate change will help plant growth, pointing to how "many academic studies and field experiments have demonstrated that increased levels of carbon dioxide can promote crop and forest

growth input." (This advertisement was republished by Greenpeace's PolluterWatch.

It's nearly impossible to account for the full array of impacts that the climate crisis could have on crop production and nutrition levels. The review, for instance, didn't mention how climate change is leading crop pathogens and invasive species to migrate to warming regions, potentially compromising the safety of crops, or the role of soil health, which also influences crop nutrient content and yields.

With the exception of nitrogen, all of the essential nutrients plants require for growth only come into the plant through the soil. However, climate change can also lead soil to degrade. "So, both wind and water erosion may be accelerated [by climate change] and impact the productivity and water retention capacity of the soil," said Rattan Lal, a professor of soil science at Ohio State University and recipient of the Japan Prize and the World Food Prize for his work on soil and climate change. As soil degrades, it lacks the micronutrients essential for its health and human health. "Soil degradation and depletion is a cause of human malnutrition," said Lal.

"We need to change the food system. We need to do it fast and we need to do it with everyone."

Protecting and restoring soil is an important way to prevent deepening malnutrition as climate change accelerates, added Lal. Healthy soil has been gaining more attention as a climate solution, though it's still lacking broad incentives in the U.S. and elsewhere. The review also points to other solutions, such as developing staple crops, which are better able to tolerate a changing climate and applying zinc and iron to the soil and foliage to increase its uptake. As more immediate solutions, they recommended national micronutrient supplement programs and enriching foods by adding essential vitamins and minerals.

It's clear there remains an immense amount of work ahead when it comes to deepening the understanding of how plants respond to climate change—and helping crops and food systems remain resilient. The review's authors are hopeful that it can contribute to a more foundational shift in the way we produce what we eat.

"We need to change the food system," said Bloem. "We need to do it fast and we need to do it with everyone."

civileats.com, 16 November 2021

https://www.civileats.com

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How massive stars in binary systems turn into carbon factories

2021-11-18

The next time you thank your lucky stars, you might want to bless the binaries. New calculations indicate that a massive star whose outer layer gets torn off by a companion star ends up shedding a lot more carbon than if the star had been born a loner.

"That star is making about twice as much carbon as a single star would make," says Rob Farmer, an astrophysicist at the Max Planck Institute for Astrophysics in Garching, Germany.

All life on Earth is based on carbon, the fourth most abundant element in the cosmos, after hydrogen, helium and oxygen. Like nearly every chemical element heavier than helium, carbon is formed in stars (SN: 2/12/21). For many elements, astronomers have been able to pin down the main source. For example, oxygen comes almost entirely from massive stars, most of which explode, while nitrogen is made mostly in lower-mass stars, which don't explode. In contrast, carbon arises both in massive and lower-mass stars. Astronomers would like to know exactly which types of stars forged the lion's share of this vital element.

Farmer and his colleagues looked specifically at massive stars, which are at least eight times heavier than the sun, and calculated how they behave with and without partners. Nuclear reactions at the core of a massive star first turn hydrogen into helium. When the core runs out of hydrogen, the star expands, and soon the core starts converting helium into carbon.

But massive stars usually have companion stars, adding a twist to the storyline: When the star expands, the companion's gravity can tear off the larger star's outer envelope, exposing the helium core. That allows freshly minted carbon to stream into space via a flow of particles.

"In these very massive stars, these winds are quite strong," Farmer says. For instance, his team's calculations indicate that the wind of a star born 40 times as massive as the sun with a close companion ejects 1.1 solar masses of carbon before dying. In comparison, a single star born with the same mass ejects just 0.2 solar masses worth of carbon, the researchers report in a paper submitted to arXiv.org October 8 and in press at the Astrophysical Journal.

If the massive star then explodes, it also can outperform a supernova from a solo massive star. That's because, when the companion star removes the

"That star is making about twice as much carbon as a single star would make," says Rob Farmer, an astrophysicist at the Max Planck Institute for Astrophysics in Garching, Germany.

massive star's envelope, the helium core shrinks. This contraction leaves some carbon behind, outside the core. As a result, nuclear reactions can't convert that carbon into heavier elements such as oxygen, leaving more carbon to be cast into space by the explosion. Had the star been single, the core would have destroyed much of that carbon.

By analyzing the output from massive stars of different masses, Farmer's team concludes that the average massive star in a binary ejects 1.4 to 2.6 times as much carbon through winds and supernova explosions as the average massive star that's single.

Given how many massive stars are in binaries, astronomer Stan Woosley says emphasizing binary-star evolution, as the researchers have done, is helpful in pinning down the origin of a crucial element. But "I think they are making too strong a claim based on models that may be sensitive to uncertain physics," says Woosley, of the University of California, Santa Cruz. In particular, he says, mass-loss rates for massive stars are not known well enough to assert a specific difference in carbon production between single and binary stars.

Farmer acknowledges the uncertainty, but "the overall picture is sound," he says. "The binaries are making more [carbon]."

sciencenews.org, 18 November 2021

https://www.sciencenews.org

How contaminated water contributes to mental illness

2021-11-19

This is part 2 of our 5-part series, Pollution's mental toll: How air, water and climate pollution shape our mental health.

PITTSBURGH—In an average week, NaTisha Washington hears from seniors forced to choose between keeping their water running or paying medical bills, moms afraid to make their baby's formula with tap water over fear of contamination, and local politicians frustrated by barriers to improving water quality.

"Many of these communities have been struggling to deal with COVID-19 and job loss and all the recent civil rights actions and discrimination issues while also not having access to safe drinking water at home," Washington, an environmental justice organizer with One PA, a nonprofit community advocacy group, told EHN.

But emerging scientific research also suggests that a common drinking water pollutant—lead—impacts mental health.

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Much of Washington's work relates to clean water access in low-income western Pennsylvania communities. The problems she sees primarily fall into two categories: Drinking water that's contaminated with lead and other toxic chemicals, and the threat of shut-offs due to nonpayment of water bills.

Both of those issues, she said, create mental health impacts like stress and anxiety.

It's not hard to imagine how fearing that your water is unsafe to drink or will be shut off could contribute to stress, anxiety, or depression. But emerging scientific research also suggests that a common drinking water pollutant—lead—impacts mental health.

Kids are exposed to lead through lead paint, contaminated soil, and contaminated drinking water, which remains a primary source of lead exposure. No level of lead exposure is safe for children, and blood lead levels lower than those that officially qualify as "poisoning" are still harmful to developing brains.

"We've known for a long time that early life lead exposure causes problems related to learning performance and cognitive deficits in children, but now that many lead-exposed [groups of children] have been followed into adulthood, we're also seeing that later in life they're more likely to have major depression, schizophrenia, and other psychiatric disorders," Tomás R. Guilarte, professor, researcher, and director of the Brain Behavior & the Environment program at the Robert Stempel College of Public Health & Social Work at Florida International University, told EHN.

"There's no question that even at low levels of exposure there are associations with neurodevelopmental and psychiatric disorders," he added.

These findings have major implications in the U.S. and abroad. While bans on lead in paint and gasoline have had a positive impact, roughly one in three children around the world are still exposed to harmful levels of lead. "This is not a trivial problem," Guilarte said.

In a survey of more than one million kids in the U.S., researchers earlier this year reported that more than half of children have detectable levels of lead in their blood. The exposure was worse for children of color: About 58% of kids from majority Black zip codes and 56% of kids from majority Hispanic zip codes had detectable levels of lead compared to 49% of kids from majority white zip codes.

In addition, about 186 million people in the U.S.—about 56% of the population—drank water from drinking water systems with lead levels above 1 part per billion (the level set by the American Academy of Pediatrics to protect children from lead in school water fountains) from 2018 to 2020, according to a report from the Natural Resources Defense Council.

Western Pennsylvania is particularly at risk:

- The percentage of Pennsylvania children with elevated blood lead levels is more than twice as high as the national rate;
- Blood lead levels in Allegheny County are declining overall, but not equitably: The percentage of children of color with confirmed elevated blood levels is six times greater than the percentage of white children with elevated blood lead levels;
- In 2019, lead was detected in 80% of water systems in Allegheny County;
- Among school districts in 10 Western Pennsylvania counties that tested drinking water for lead in 2019, 71% reported lead contamination, but less than half took action to remove it.

In October, the Centers for Disease Control and Prevention (CDC) lowered the threshold for blood lead levels considered "higher than average" from 5 micrograms per deciliter to 3.5 micrograms per deciliter.

This shift will mean that many more children in Allegheny County and across the country will be considered to have blood lead levels requiring intervention. Currently, when a child is found to have a blood lead level higher than the CDC's previous threshold of 5 micrograms per deciliter in Allegheny County, the Allegheny County Health Department offers a free home investigation to test water, dust, and soil samples for lead.

Chris Togneri, the health department's public health information officer, told EHN the agency is still reviewing the CDC's revised threshold to consider updating that policy.

In addition to its lead exposure and drinking water issues, western Pennsylvania also bears a substantial burden of mental illness.

From 2018-2020, 40% of adults in Allegheny County reported having one or more days where their mental health was "not good," according to state data, a figure that's higher in Allegheny County than in half of other Pennsylvania counties, and slightly higher than state averages. An

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estimated 13% of adults in Allegheny County said their mental health was not good for 14 or more days a month.

A survey conducted by the Allegheny County Health Department from 2015-2016 indicates the issue is even more serious among non-white residents: 48% of Black and 47% of Hispanic residents said their mental health was "not good" for one or more days a month, compared to 42% of white residents.

Togneri said the Allegheny County Health Department works to address disparities in lead exposure through an index which ranks census tracts where children are more vulnerable to lead exposures based on factors like race, poverty level, and the age of housing.

"We do increased outreach in the areas that are identified as being at higher risk levels," he said. "As is the case in all departments, more resources would allow for greater outreach."

In Pittsburgh, the number of pediatric patients seeking mental health treatment has increased by 30% since the spring of 2020. Meanwhile, Pennsylvania is experiencing a statewide shortage of mental health care workers, and in Pittsburgh therapists are quitting their jobs in droves because of burnout.

This is your brain on lead

Guilarte has been studying lead exposure since the 1980s, when lead poisoning among children was rampant.

He was the lead author on a 2021 literature review that looked at dozens of human and animal studies and found increasing evidence that childhood lead exposure is a risk factor for psychiatric disorders like anxiety, depression, and obsessive compulsive disorders, and neurodevelopmental disorders like ADHD, autism, and Tourette syndrome.

The largest of these studies looked at more than 1.5 million people in the U.S. and Europe and found that people who had higher lead exposure as children were more likely to have negative personality traits like lower conscientiousness, lower agreeableness, and higher neuroticism in adulthood (all of which contribute to mental illness).

"Lead exposure impacts a protein receptor in the brain known as the NMDA receptor, which is critically important for brain development, learning, and cognitive function," Guilarte said, adding that improper functioning of the NMDA receptor is also seen in the brains of people with

certain mental illnesses (like schizophrenia). The NMDA receptor influences the development of inhibitory neurons that help keep the brain balanced. When it's damaged by lead exposure, it creates too few of those neurons.

"In a healthy brain you have excitatory and inhibitory neurons operating in exquisite balance," Guilarte explained, "but if that's interrupted and you have too many of one or the other, the brain goes haywire."

For decades, scientists only considered the impacts these changes had on children's brains while they were still children, but emerging research suggests some symptoms of the damage done by lead don't emerge until adulthood or even middle age.

The poisoning of a generation

Aaron Reuben, a researcher at Duke University, led the longest study ever conducted on early life lead exposures and mental health outcomes in adulthood. It followed 579 people in New Zealand from the time they were 3 years old until they were 38 years old, and found that people who were exposed to higher levels of lead as children were more likely to experience symptoms of mental illness as adults, including antisocial behavior, eating disorders, depression, anxiety, post-traumatic stress, substance abuse, delusions, and hallucinations.

"Because we've been following these kids for so long we can also look at where they are as adults compared to where their parents were when the study started," Reuben told EHN. "We've found that kids with low levels of lead exposure tend to do a little better than their parents on the whole in terms of socioeconomic standing, but for kids at the higher end of lead exposure, they appear to have slipped down the ladder compared to their parents and have lower social mobility."

The mean blood lead level for children in the study was 11 micrograms per deciliter. That level is higher than most kids experience today, but it still happens—in Allegheny County at least 582 tests showed blood lead levels higher than 10 micrograms per deciliter in children younger than six between 2016 and 2020, and across the U.S. as many as 243,749 children currently have blood lead levels higher than 10 micrograms per deciliter.

More significantly, that level of lead exposure is representative of the exposures experienced by an entire generation.

"The levels of exposure we looked at are typical for kids born in the 70s in most places in the world when lead was still being widely added to paint and gasoline," Reuben said. "I've estimated that there are about a hundred

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million people in their forties and early fifties living in America who had high lead exposures as kids."

Western Pennsylvania has a large population of residents in that age bracket.

In Allegheny, Butler, Washington, and Westmoreland Counties—the four most populated counties in Western Pennsylvania—there are around 371,656 people between the ages of 40 and 54 who likely experienced high levels of lead exposure as children.

In 2016, 18 Pennsylvania cities including Pittsburgh, Altoona, Johnstown, and Erie had higher levels of lead exposure among children than those seen in Flint, Michigan, at the height of its lead crisis.

Additionally, recent reporting on Pittsburgh's lead crisis revealed that lead levels in the Pittsburgh Water and Sewer Authority's [PWSA's] water rose steadily from 1999 to 2016, and that because of inconsistent testing, the region's water could have had dangerously high levels of lead contamination for years before it was caught during the city's "lead crisis." The county didn't mandate universal blood lead screening for kids until 2018, so it's difficult to assess just how widespread lead exposure was during that time period.

Even today, despite the county's universal lead screening program, about 35% of kids in the region aren't getting tested for lead exposure. In many parts of the country, the percentage of kids getting screened for lead declined sharply last year, likely due to the COVID-19 pandemic.

"We don't have a good understanding of where those children are or why that's happening," Michelle Naccrati-Chapkis, executive director of the health advocacy nonprofit Women for a Healthy Environment, told EHN.

The legal federal limit for lead in public water systems is 15 parts per billion (ppb), and PWSA's lead levels were higher than that from at least 2013-2016. Across the country, about seven million people were served by drinking water systems that exceeded the 15 ppb threshold from 2018 to 2020, according to the NRDC report.

The U.S. Environmental Protection Agency (EPA) has set a non-enforceable health goal for lead in public drinking water of zero. In 2019 the agency proposed revisions to the Lead and Copper Rule that would lower the action level from 15 ppb to 10 ppb and create stricter requirements for replacing lead service lines, but those revisions haven't yet been passed.

Overlapping impacts

Across the country, the COVID-19 pandemic has taken a huge toll on mental health. In October, the American Academy of Pediatrics, the American Academy of Child and Adolescent Psychiatry, and the national Children's Hospital Association declared a national emergency in children's mental health.

"We need more mental health resources and capacity, especially for those in extreme mental health crises," Marita Garrett, the mayor of Wilkinsburg, a small borough about eight miles from downtown Pittsburgh, told EHN.

Wilkinsburg is one of many communities surrounding Pittsburgh that's had ongoing problems with childhood lead exposure.

In October, the city of Pittsburgh announced a new lead ordinance that will require testing for lead paint and dust in rental housing built before 1978 (when lead paint was banned), implementing lead safety plans for repairs and demolitions of buildings that could contain lead paint, and installing drinking water filters at city-owned water facilities.

But Allegheny County is home to 130 self-governing municipalities—more than any other county in the state—and the Pittsburgh ordinance won't apply to them. Many, including Wilkinsburg, have government agencies that are under-funded and under-staffed. Garrett said old lead water lines in Wilkinsburg need to be replaced, but it's expensive.

Naccrati-Chapkis said Lead Safe Allegheny, a local coalition of government agencies and nonprofits, hopes to help other municipalities in the county use the Pittsburgh lead ordinance as a model to pass their own.

Meanwhile, communities with childhood lead exposures are also likely to experience other issues that can disproportionately impact people's mental health, including poverty, racism, violence, and other harmful environmental exposures, including air pollution.

Wilkinsburg, for example, is a majority non-white community that experiences high levels of air pollution from U.S. Steel's Edgar Thomson Mill and has a poverty rate of more than 24%.

In these types of communities, Guilarte said, "It's almost like the perfect storm for these children to have developmental problems." He noted that lead poisoning is linked to higher rates of crime and violence, and that mental illness likely plays a role.

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Communities with high levels of poverty are more likely to have lead in their water, but research has also shown that regardless of income level, Black children in the U.S. are two to three times as likely as white and Hispanic children to experience lead poisoning—a lingering effect of racist practices like redlining and a clear result of environmental injustice.

"This is a pure consequence of our history of systemic racism and a racialized caste system in America that has still not been adequately addressed today," Reuben said.

Some of the most high-profile national cases of widespread lead contamination in drinking water have been in majority Black communities, including Flint, Michigan; Newark, New Jersey; East Chicago, Indiana; and Benton Harbor, Michigan, which is unfolding right now.

Examples of "toxic zip codes"—regions where a combination of environmental injustice, poverty, and violence create substantial negative health impacts—abound in western Pennsylvania

For example, the Monongahela Valley (commonly referred to as the "Mon Valley"), a former steel corridor of municipalities from the southern tip of Pittsburgh to the West Virginia border, is home to a large number of environmental justice communities (census tracts with a poverty rate of at least 20% and/or a non-white population of at least 30%) and also faces disproportionate risk of lead exposure.

Duquesne is a Mon Valley town about 10 miles southeast of Pittsburgh that's about 70% non-white (compared to Allegheny County as a whole, which is 80% white). In June, during one of 10 virtual discussions about the Lead and Copper Rule between representatives from the EPA and cities across the country, Duquesne Mayor Nickole Nesby told the agency that on average, children tested in Duquesne for blood lead levels have an average of 7 micrograms per deciliter.

"Those children are going to need medical services," Nesby told EHN, pointing to the city's high poverty rate and noting that 33% of the city's school children have learning disabilities. At the state level, about 17% of children have learning disabilities. "We don't even have a medical facility in Duquesne. We need medical care and we need medical research."

In addition to lead problems, Duquesne's drinking water contains levels of unregulated contaminants linked to cancer at rates up to 400 times higher than recommended health limits.

Duquesne buys its water from the Municipal Authority of Westmoreland County, but Nesby said contaminants enter the water once it flows through Duquesne's aging infrastructure, which would cost millions of dollars to repair that the city doesn't have. Nesby is hoping to use some COVID-relief funds toward that end. She recently traveled to Washington, D.C. to talk about her city's infrastructure needs before the U.S. Chamber of Commerce.

"Our water department is just run amok," she said. "We need help."

A 2018 report by the Allegheny County Health Department identified the census tracts in the county with the highest levels of lead exposure risk based on factors like what percentage of homes were built before 1950 (when lead paint and lead water pipes were more common) and what percentage of the population is under 5 years old. Many of those census tracts fall within the Mon Valley.

These overlapping impacts can also have physical effects that impact mental health.

"There's evidence that one harmful exposure changes the brain in a way that can magnify the effects of another harmful exposure later on," said Reuben, who has also studied the impacts of air pollution on mental illness. "So it's not an additive effect—one plus one equals two—but a synergistic effect, where if you're getting one hit from lead exposure and one from air pollution, they combine to create three or four hits."

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How climate change may shape the world in the centuries to come

2021-11-19

It's hard to imagine what Earth might look like in 2500. But a collaboration between science and art is offering an unsettling window into how ongoing climate change might transform now-familiar terrain into alien landscapes over the next few centuries.

These visualizations — of U.S. Midwestern farms overtaken by subtropical plants, of a dried-up Amazon rainforest, of extreme heat baking the Indian subcontinent — emphasize why researchers need to push climate projections long past the customary benchmark of 2100, environmental

Fifty years have passed since the first climate projections, which set that distant target at 2100, says Lyon, of McGill University in Montreal.

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social scientist Christopher Lyon and colleagues contend September 24 in Global Change Biology.

Fifty years have passed since the first climate projections, which set that distant target at 2100, says Lyon, of McGill University in Montreal. But that date isn't so far off anymore, and the effects of greenhouse gas emissions emitted in the past and present will linger for centuries (SN: 8/9/21).

To visualize what that future world might look like, the researchers considered three possible climate trajectories — low, moderate and high emissions as used in past reports by the United Nations' Intergovernmental Panel on Climate Change — and projected changes all the way out to 2500 (SN: 1/7/20). The team focused particularly on impacts on civilization: heat stress, failing crops and changes in land use and vegetation (SN: 3/13/17).

For all but the lowest-emission scenario, which is roughly in line with limiting global warming to "well under" 2 degrees Celsius relative to preindustrial times as approved by the 2015 Paris Agreement, the average global temperature continues to increase until 2500, the team found (SN: 12/12/15). For the highest-emissions scenario, temperatures increase by about 2.2 degrees C by 2100 and by about 4.6 degrees C by 2500. That results in "major restructuring of the world's biomes," the researchers say: loss of most of the Amazon rainforest, poleward shifts in crops and unlivable temperatures in the tropics.

The team then collaborated with James McKay, an artist and science communicator at the University of Leeds in England, to bring the data to life. Based on the study's projections, McKay created a series of detailed paintings representing different global landscapes now and in 2500.

The team stopped short of trying to speculate on future technologies or cities to keep the paintings based more in realism than science fiction, Lyon says. "But we did want to showcase things people would recognize: drones, robotics, hybrid plants." In one painting of India in 2500, a person is wearing a sealed suit and helmet, a type of garment that people in some high-heat environments might wear today, he says.

The goal of these images is to help people visualize the future in such a way that it feels more urgent, real and close — and, perhaps, to offer a bit of hope that humans can still adapt. "If we're changing on a planetary scale, we need to think about this problem as a planetary civilization," Lyon

says. "We wanted to show that, despite the climate people have moved into, people have figured out ways to exist in the climate."

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[Endocrine Disruptors: what are we talking about and what new mecanisms of toxicity do they bring into play?]

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