



Emerging Pollutants: Protecting Water Quality for the Health of People and the Environment

The Main Categories of Contaminants of
Emerging Concern (CECs) in Global
Groundwater

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(Main Points)

1) **CECs are: Toxic** – the nature & severity of the toxicity is variably undefined

Unregulated – no environmental laws

CECs are not monitored – periodic sampling & lab testing needed

2) A literature review indicates there are **6 main categories of CECs in groundwater**:

1) Pharmaceuticals, 2) personal care or household cleaning products, 3) industrial chemicals, 4) flame retardants, 5) cyanotoxins, and 6) nanomaterials.

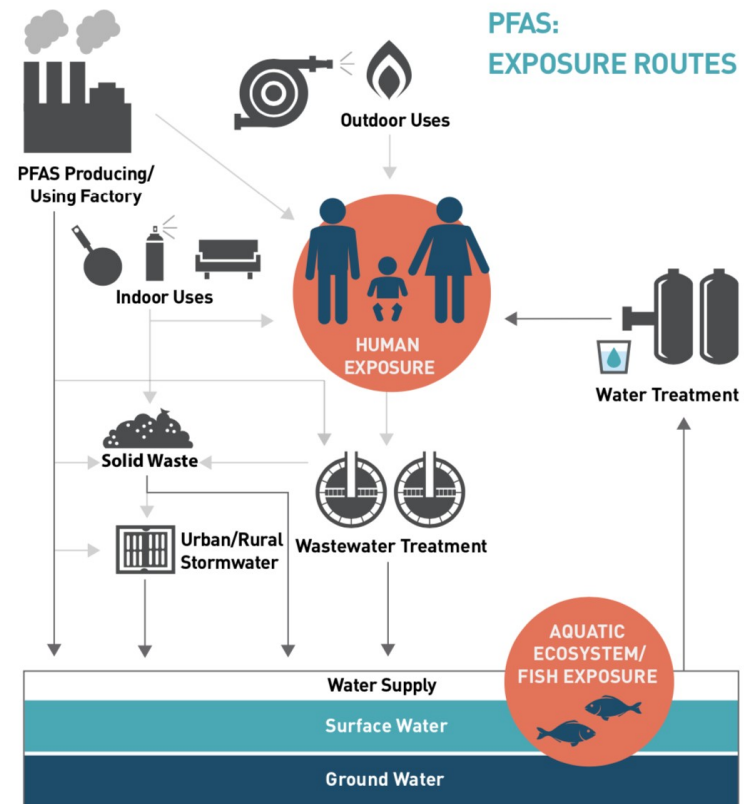
3) Of all CECs, PFAS has the highest certainty of causing human health problems.
take immediate action to control the release and dispersal of PFAS.

Countries need to

Countries should follow the European Commission: **Identify & control sources of PFAS**; finalize legislation to **eliminate the widespread release of PFAS compounds in biosolids (from WWTPs)** that are used as soil amendments for agricultural areas, as the PFAS compounds currently continue to **leach into underlying groundwater**.

4) **Aside from PFAS, more sustained groundwater monitoring is needed for certain toxic pharmaceuticals & common toxic compounds in cosmetics/personal care products**

How PFAS Moves in the Environment



PFAS: Ubiquitous, Carcinogenic; the best candidate for immediate action

PFAS are in the CEC categories of Industrial Chemicals AND Cosmetics/Personal Care Products

Examples of PFAS-bearing products are:

- non-stick coatings (Teflon),
- textiles (Gore-Tex),
- stain-resistant carpets and sofas, and
- aqueous firefighting foams to engulf flames (AFFF).

PFAS water pollution has been confirmed in the European Union (EU), Asia, Australia, the Middle East, Canada, and the United States,

Examples of other Industrial Chemicals

Pesticides *and their metabolites/breakdown products*

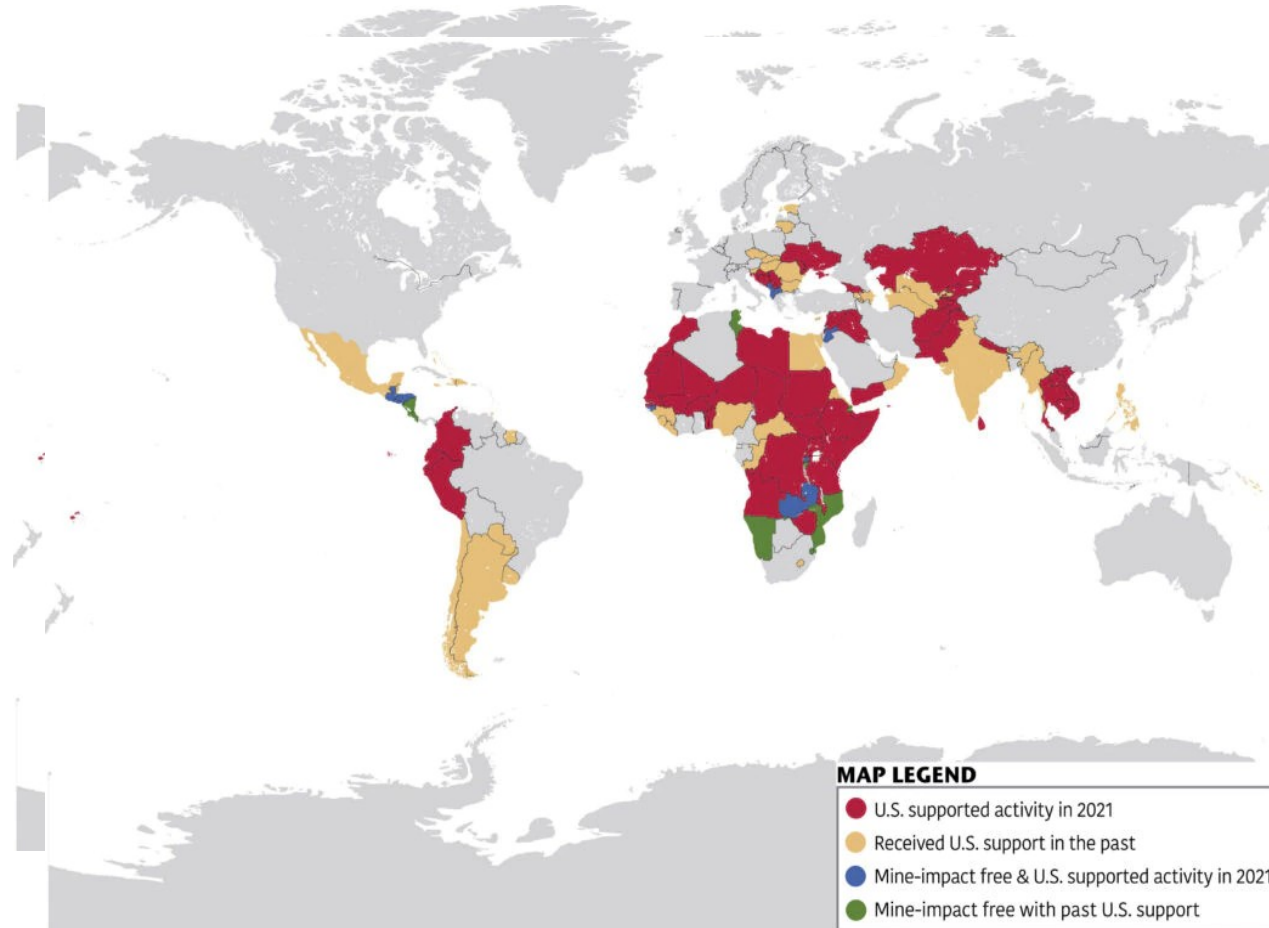
1,4 – Dioxane: Used in pharmaceutical purification, and plastics production

Explosives:

Explosives compounds contamination in groundwater is very poorly known and assumed present in areas coincident w/ unexploded ordnance (UXO) in Cambodia, Laos, Vietnam, North Korea, South Korea, Afghanistan, Yemen, various South African countries, Iraq, Angola and Chechnya

20% of the land area of Cambodia, Laos and Vietnam have unexploded ordnance

Countries with Unexploded Ordnance as of 2021



Pharmaceuticals: Another Major Category of CECS

Antibiotics

analgesics/pain relievers

antidiabetics

blockers (for heart disease and high blood pressure)
fats and vitamins that store energy)

anti-inflammatories

antiepileptics

beta-

lipid regulators (lipids are

Monitoring (sampling and lab testing to define concentrations) in groundwater is not occurring

Concentrations in groundwater above which adverse health effects may occur not established

Personal Care & Household Cleaning Products: Another CEC Category

These include cosmetics, deodorants, cleansers (soap, shampoo, toothpaste), moisturizers, perfumes, sunscreens, hair styling sprays and foams, and shaving creams.

Here are examples of toxic compounds **in cosmetics**:

Formaldehyde (carcinogenic)

Mercury (damages kidneys and nervous system)

Dibutyl & diethylhexyl phthalates (disrupt hormones, damage reproductive system)

M- & O- phenylenediamine in hair dyes (carcinogenic – damage DNA)

PFAS

Flame Retardants: Another CEC Category

Brominated flame retardants (BFRs) are an enormous category of CECs, used to reduce flammability in computers, plastics, furniture and clothing.

Polybrominated diphenyl ethers (PBDE) are a common class of flame retardant compounds

Many flame retardant compounds, as well as pharmaceuticals, personal care products, and industrial chemicals such as PFAS, act as so-called **endocrine disruptors (EDCs)**.

EDCs are compounds that adversely alter the normal functions of hormones.

Cyanotoxins: Another CEC Category

Cyanotoxins are toxic chemicals released from bacterial blooms

Cyanobacteria are commonly referred to as blue-green algae, although not scientifically classified as algae

They can proliferate in groundwater as a result of additions of nitrogen and phosphorus from fertilizer runoff and detergents in urban areas.

The toxins are generally poorly documented; they reduce water quality and can adversely affect wildlife and humans.

Cyanobacteria



Nanomaterials: another CEC Category

Also referred to as nanoparticles

Used in hundreds of consumer products and biomedical applications

They are typically 1-100 nanometers (a nanometer is one-millionth of a meter)

Examples are carbon fiber, and metals such as aluminum or silver

Relatively few toxicity studies have been conducted on these nascent or established materials

Nanomaterials



Summation

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