Forever chemicals' used in lithium ion batteries threaten environment, research finds

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Toxic PFAS "forever chemicals" used in lithium ion batteries essential to the clean energy transition present a dangerous source of chemical pollution that new research finds threatens the environment and human health as the nascent industry scales up.

The multipronged, peer-reviewed study zeroed in on a little-researched and unregulated subclass of PFAS called bis-FASI that are used in lithium ion batteries.

Researchers found alarming levels of the chemicals in the environment near manufacturing plants, noted their presence in remote areas around the world, found they appear to be toxic to living organisms, and discovered that waste from batteries disposed of in landfills was a major pollution source.

The nation faces "two critical challenges – to minimize aquatic pollution and increase our use of clean and sustainable energy, and both are worthy causes", said Jennifer Guelfo, a Texas Tech University researcher and study co-author.

"But there's a bit of tug-of-war between the two, and this study highlights that we have an opportunity now as we scale up this energy infrastructure to do a better job of incorporating environmental risk assessments," she added.

PFAS are a class of about 16,000 human-made compounds most often used to make products resistant to water, stains and heat. They are called "forever chemicals" because they do not naturally break down and have been found to accumulate in humans. The chemicals are linked to cancer, birth defects, liver disease, thyroid disease, plummeting sperm counts and a range of other serious health problems.

Public health advocates are increasingly sounding the alarm over the need to find alternatives to the toxic chemicals for clean energy technology, such as batteries and wind turbines, as the transition progresses.

The paper notes that few end-of-life standards for PFAS battery waste exist, and the vast majority ends up in municipal dumps where it can leach into waterways, accumulate locally or be transported long distances.

It looked at the presence of the chemicals in historical leachate samples and found none in those from prior to the mid-1990s, when the chemical class was commercialized.

The study noted previous research that bis-FASI can be reused, though as little as 5% of lithium batteries are recycled. That could yield a projected 8m tons of battery waste by 2040 if battery recycling is not dramatically scaled up with demand.

“This says that we should be taking a closer look at this class of PFAS,” Guelfo said.

Since very little toxicological data on bis-FASI exists, the study also checked for effects on invertebrates and zebrafish. It found effects at low exposure levels, which suggests toxicity in line with other PFAS compounds known to be dangerous.

Researchers also sampled water, soil and air around a 3M plant in Minnesota and other large facilities known to make the chemicals. The soil and water levels were concerning, Guelfo said, and detection of the chemicals in snow suggests the chemicals easily move through the atmosphere.

That may help explain why the chemicals have been found in Chinese seawater and other remote areas not close to production plants.

While the most commonly used PFAS definitions globally include bis-FASI, one division of the EPA does not consider it to belong to the chemical class, so it was not included on a list of compounds to be monitored in US water. The EPA has drawn criticism for using a narrow definition of PFAS that public health advocates say has excluded some chemicals at the industry’s behest.

However, the new research, taken with previous evidence, shows bis-FASI are persistent, mobile and toxic like most other PFAS, noted Lee Ferguson, a Duke University researcher and co-author.

“That classification combined with the huge ramp-up in clean energy storage that we’re seeing should at least ring some alarm bells,” he said.