New plutonium research helps distinguish nuclear power pollution from global fall out

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Researchers looking at miniscule levels of plutonium pollution in our soils have made a breakthrough which could help inform future 'clean up' operations on land around nuclear power plants, saving time and money.

Publishing in the journal *Nature Communications*, researchers show how

they have measured the previously 'unmeasurable' and taken a step forward in differentiating between local and global sources of plutonium pollution in the soil.

By identifying the isotopic 'fingerprint' of trace-level quantities of plutonium in the soil which matched the isotopic fingerprint of the plutonium created by an adjacent nuclear reactor, the research team was able to estimate levels of plutonium in the soil which were attributable to reactor pollution and distinguish this from plutonium from general global pollution.

This is important to provide key information to those responsible for environmental assessment and clean up.

Plutonium formed in the big bang decayed away long ago, but miniscule quantities can be found in the environment as a result of reactions in naturally occurring uranium in the ground, and due to human activity. The latter occur local to their source of production, for example, from nuclear plant effluents, reactor accidents, accidents involving nuclear weapons and plutonium-powered space probes. They also occur globally from fallout from atmospheric nuclear weapon tests which took place between the 1950s and 1980.

In the absence of human intervention, the amount of plutonium in the earth varies very slowly with time due to the long half-lives of most plutonium isotopes and relatively slow natural transport mechanisms.

The ability to differentiate between local sources of plutonium and global fallout is important to inform decisions concerning nuclear legacies, particularly the clean-up of contaminated land.

Given this context, the study set out to determine whether the local contribution to trace plutonium levels on the site of a fast breeder

nuclear reactor might be discerned from the global contribution.

Using accelerator mass spectrometry (one of the most sensitive ways to measure plutonium), the researchers, from Lancaster University, ETH Zürich, and Dounreay Site Restoration Ltd, were able to demonstrate this was possible and say their research findings could help inform the extent to which clean-up of the local plutonium might be necessary.

Professor Malcolm Joyce, of Lancaster University and Principal Investigator, said: "Plutonium is primordially extinct but that does not mean we don't find it in the earth. Up until 1980 many nuclear weapons were tested in the atmosphere—this coupled with other forms of pollution, has resulted in trace levels of pollution.

"Our study showed we've measured what one might have assumed was 'unmeasureable', differentiating between two very different sources of trace amounts of plutonium, hence demonstrating that it is possible to measure this extraordinarily low-level indicator of human activity if we need to do so."

More information: Local and global trace plutonium contributions in fast breeder legacy soils, *Nature Communications* (2021). DOI: 10.1038/s41467-021-21575-9

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