Butterfly molecule may aid quest for nuclear clean-up technology

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Scientists have produced a previously unseen uranium molecule, in a development that could help improve clean-up processes for nuclear waste.

The distinctive butterfly-shaped compound is similar to radioactive molecules that scientists had proposed to be key components of nuclear waste, but were thought too unstable to exist for long.

Researchers have shown the compound to be robust, which implies that molecules with a similar structure may be present in radioactive waste.

Scientists at the University of Edinburgh, who carried out the study, say this suggests the molecule may play a role in forming clusters of radioactive material in waste that are difficult to separate during clean-up.

Improving treatment processes for nuclear waste, including targeting this type of molecule, could help the nuclear industry move towards cleaner power generation, in which all the radioactive materials from spent fuel can be recovered and made safe or used again. This would reduce the amount of waste and curb risks to the environment.

The Edinburgh team worked in collaboration with scientists in the US and Canada to verify the structure of the uranium compound. They made the molecule by reacting a common uranium compound with a nitrogen and carbon-based material. Scientists used chemical and mathematical

analyses to confirm the structure of the molecule's distinctive butterfly shape.

The study, funded by the Engineering and Physical Sciences Research Council, the EaStCHEM partnership and the University of Edinburgh, was published in *Nature Chemistry*.

Professor Polly Arnold of the University of Edinburgh's School of Chemistry, who took part in the research, said: "We have made a molecule that, in theory, should not exist, because its bridge-shaped structure suggests it would quickly react with other chemicals. This discovery that this particular form of uranium is so stable could help optimise processes to recycle valuable radioactive materials and so help manage the UK's nuclear legacy."

Provided by University of Edinburgh