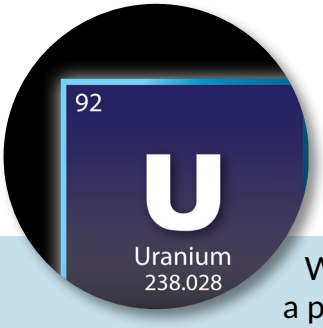
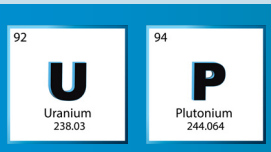
UTAH OFFICE OF
ENERGY DEVELOPMENT

Recoverable Elements in Nuclear Spent Fuel

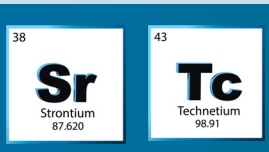


Spent nuclear fuel contains several groups of elements with distinct characteristics and potential uses, shaped by their chemical properties, radioactivity and role in energy production or waste management.

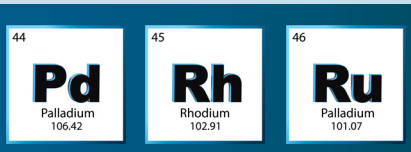
When nuclear fuel is used in a reactor, heavy atoms like uranium split apart in a process called fission, releasing energy for electricity and creating a mix of new elements inside the fuel. The specific combination of elements produced varies each time due to the unpredictable nature of fission and differences in reactor technologies. Below are some common examples of elements recovered from spent fuel and their applications.



Uranium and **plutonium,** when recovered from spent fuel are mainly reused as fuel in nuclear reactors. Recycled uranium can be re-enriched and used again to generate electricity, while plutonium is often mixed with uranium to create mixed oxide (MOX) fuel, which also powers nuclear reactors.



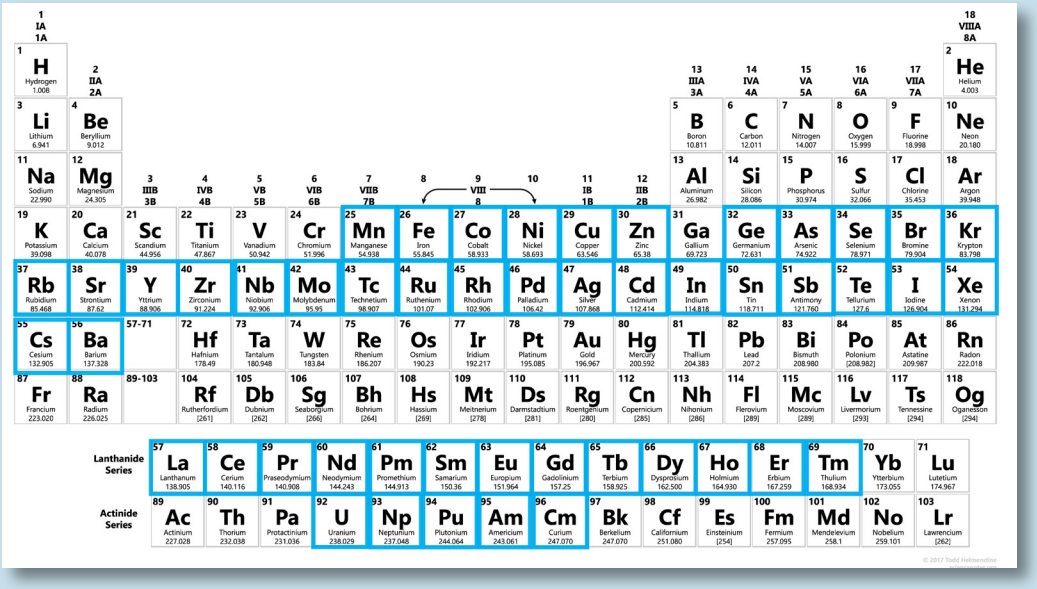
Strontium and **technetium,** are used in the medical industry. Strontium-89 and -90 are used to treat bone cancer as these isotopes accumulate in bone tissue and deliver targeted radiation therapy. Technetium-99m is the most widely used radioisotope in diagnostic imaging. It can be attached to various compounds to image organs such as heart, brain and bones with minimal radiation exposure.



Palladium, Rhodium and **ruthenium** are all members of the platinum group metals. These metals are present in significant quantities in spent fuel and are considered valuable for industrial uses such as catalysts in chemical manufacturing and automotive exhaust emission control systems.

Risk Management

Risks from recovering and recycling spent nuclear fuel are mitigated by strict safety regulations, secure storage and transport systems, and international oversight. Robust containers, careful handling, and constant monitoring help prevent accidents, theft, or environmental harm, while agencies like the International Atomic Energy Agency enforce standards to ensure public and environmental safety.



Spent nuclear fuel contains significant amounts of up to 40 elements (outlined in blue above,) including uranium, plutonium, and fission products, plus trace amounts of nearly every element up to uranium due to reactor processes.