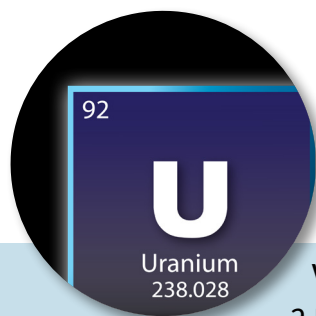




Recoverable Elements in Nuclear Spent Fuel



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.

92	U	94	P
Uranium	238.03	Plutonium	244.064

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.

38	Sr	43	Tc
Strontium	87.620	Technetium	98.91

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.

44	Pd	45	Rh	46	Ru
Palladium	106.42	Rhodium	102.91	Palladium	101.07

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.

1 1A 1 H Hydrogen 1.008																	2 2A 4 Be Beryllium 9.012																	3 3A 11 Na Sodium 22.990	4 4A 12 Mg Magnesium 24.305																	5 5A 13 B Boron 10.811	6 6A 14 C Carbon 12.011	7 7A 15 N Nitrogen 14.007	8 8A 16 O Oxygen 15.999	9 9A 17 F Fluorine 18.998	10 10A 18 Ne Neon 20.180	11 11A 19 K Potassium 39.098	12 12A 20 Ca Calcium 40.078																	13 13A 31 Al Aluminum 26.982	14 14A 32 Si Silicon 28.086	15 15A 33 P Phosphorus 30.974	16 16A 34 S Sulfur 32.065	17 17A 35 Cl Chlorine 35.453	18 18A 36 Ar Argon 39.948
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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.