

# DENSIFIED FORM FOR NUCLEAR WASTE STORAGE

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Technology Readiness Level: 3

Concept &/or application formulated

After decades of utilizing nuclear energy, the United States and countries abroad have been seeking effective methods to store radioactive waste from spent nuclear fuel. Conventionally, the international community has been able to integrate radioisotopes into borosilicate glass waste forms, but there are exceptions to this method. One example is Iodine, which is sensitive to the high temperatures required in traditional waste form processing. Iodine is contained in certain materials such as AgI, AgI-zeolite or I-containing Metal-Organic Framework (MOF) materials. Iodine radioisotopes, such as  $^{129}\text{I}$ , pose a major threat to the environment and human health, calling for an innovative waste form method that is durable and effective.

Researchers at Sandia have developed a new method to create waste forms specifically for temperature-sensitive waste materials. Instead of melting the materials into glass, Sandia scientists utilize a metallic powder, such as tin, to form a matrix to contain the radioactive material. To form a solid, dense matrix, uniaxial pressure is applied at  $\sim 15,000$  psi to meld the metallic powder and radioactive material together. Melding is used to isolate and eliminate interconnections between pores that may allow for gas or liquid to pass through, resulting in low waste outgassing and low rates of leaching. After the matrix undergoes the melding process, it can sequester, immobilize, and isolate the temperature sensitive material from the environment. Unlike glass waste forms, this simple processing method can be carried out at room temperature with inexpensive materials and effectively contains harmful radioactive waste. Furthermore, this waste form is phase compatible with a large range of waste materials.



*Tin matrix waste form mixed and pressed at 25,000 psi.*

## TECHNICAL BENEFITS

- Low material cost
- Simple processing that can be carried out at room temperature
- Low waste outgassing and low rates of leaching into groundwater over time

## INDUSTRIES & APPLICATIONS

- Nuclear waste storage