

## FACT SHEET: Hot-Isostatic Pressing (HIPing)

### Background

Hot-isostatic pressing technology was invented in the 1950s at the Battelle Memorial Institute (US).

Components to be processed are placed in an electrically heated furnace, inside a pressure vessel, and pressure applied by compressing a gas, such as argon.

### World Wide Applications

HIPing is a global technology used by a wide range of industry over the past 50 years. Companies such as Bodycote (US & UK) and Kobe (Japan) use HIPing in areas such as metallic castings, sputtering targets, cutting tools, powder metallurgy and ceramic components. Tons of metallic and ceramic components are processed on a daily basis.

### Nuclear Applications:

The HIP process is used in the nuclear industry. In the US HIPs are used to process submarine fuel. These units have a large 1.2 m (4 ft) diameter hot zone.

US National laboratories in Idaho, Oak Ridge, Los Alamos and Livermore have all operated HIPs with radioactive materials. HIPs are installed in hot-cell facilities.

synrocANSTO operates HIPing facilities for radioactive waste forms and has 15 years of associated process experience in the implementation of HIPing for nuclear waste immobilization.

### Advantages of HIPing - Waste Processing

- **Zero off-gas emissions** – nuclear waste forms are HIPed in sealed cans and consequently there are no volatile emissions.
- **Higher waste loadings & wider processing windows** – unlike other consolidation technologies HIPing does not require the control of electrical properties, melting temperature or viscosity of the waste form, permitting significantly higher waste loadings.
- **Minimum disposal volume** – the application of isostatic pressure at temperature ensures

maximum waste form compaction resulting in minimum volumes for disposal.

- **Mature flexible technology** – May be used with a diverse range of HLW waste forms and can be applied over a wide range of temperatures and pressures.
- **No major secondary wastes** - there is no direct contact or reaction between the waste form and processing equipment protecting it from contamination

### Safe Technology

HIPing is a safe, mature industrial process.

### Pressure vessels:

These are designed and built to stringent codes, such as TUV and ASME. The conservative ASME code and inspection regime, ensure vessel integrity is maintained over its service life. Other safety systems comprise active and passive over-pressure control systems and wire wrapped safety shields and yokes.

### HIP cans:

By design welds are placed under compression during the HIP process, which ensures welds are self-healing. In addition, all welds are helium leak tested prior to filling the can with the waste form. These precautions ensure *can failure rates are less than 0.1%*.



Top-section of a production HIP built by AIP Inc.

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