Firing

The charged reactor vessel is next placed in a gas fired furnace. The furnace is cylindrical in shape and the vessel is placed in it from below by a hydraulic ram. Heat input is controlled by the surface temperature on the outside of the reactor vessel and is measured by several thermocouples. The surface temperature is held at about 1200°F. The reaction takes place after from 11 to 14 hours heating and proceeds very rapidly being complete in a few seconds. A large amount of heat is given off in the reaction and the uranium metal formed is in a molten state as is the magnesium fluoride.

As uranium is a very dense metal with a specific gravity of over 18.5 it flows to the small section at the bottom of the reactor vessel while the lighter magnesium fluoride floats on top of it as a slag layer.

After several hours during which time the uranium metal and magnesium fluoride slag solidify, the fired reactor vessel is removed to a cooling chamber where it is allowed to cool for about three days.

Break Out

After cooling the lid is removed from the reactor vessel and, using an overhead crane, the vessel is dumped out on a grizzly screen with about five-inch openings in it. The slag and the liner come out first and are broken up and fall through the grizzly. The slag, from white to grey in colour and not unlike limestone in appearance, comes out in large chunks which are easily broken up with sledge hammers. The slag and liner material are crushed and milled to provide liner material for subsequent firings.

The uranium metal remains behind on the grizzly in the form of a solid cylinder roughly 18 inches in diameter by about 20 inches high. This is removed to a lathe for machining.

Machining

The crude ingot, as removed from the reactor vessel, has quite a rough surface which may include considerable slag inclusions, particularly on the top. In fact, in some firings the slag and metal do not separate cleanly and the top has to be sawed off down to clean metal prior to machining.

The machining of the ingot is done in a standard vertical lathe and sides, top and bottom are machined until all surface flaws or imperfections have been removed.

About 80% of the uranium present in the original green salt is recovered as uranium metal in the machined ingot. The remaining uranium is recovered from lathe turnings and from excess slag produced and is recycled back to solvent extraction operations.

The machined ingot is the final product of uranium metal operations at Eldorado, Port Hope.

Subsequent Metal Fabrication

The machined ingots are shipped to Sorel Industries Limited near Montreal for subsequent forging and rolling to rods or flats as required. These rods and flats are then shipped to AMF Atomics (Canada) Limited at Port Hope for final fabrication of finished fuel elements for use in the reactors at Chalk River.

An alternative method for producing billets is to melt the crude or machined ingot in a vacuum furnace. The molten metal is then cast in graphite