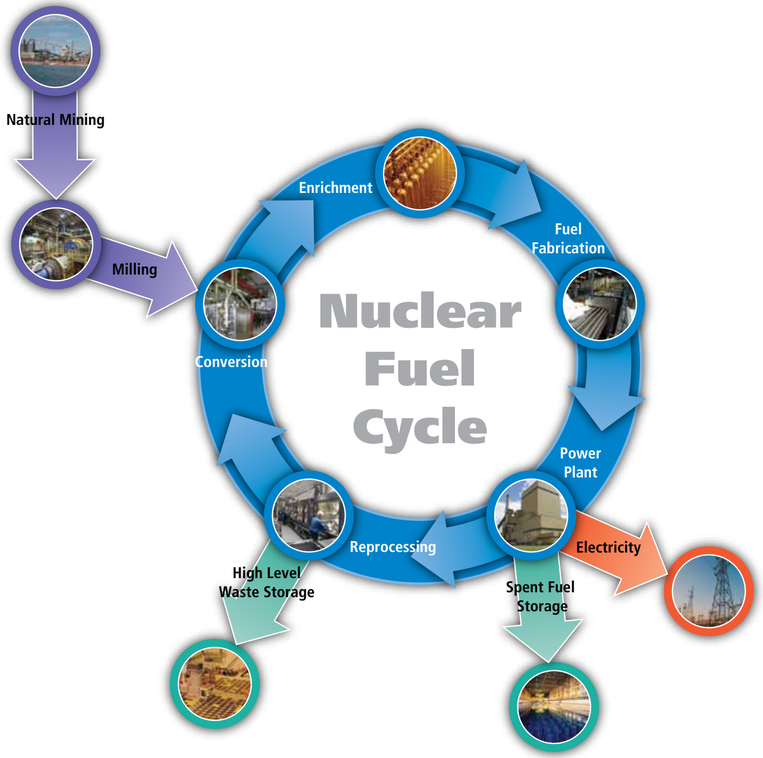
Quality and Standards for your converted material

- *Westinghouse will deliver on its promise of providing quality assurance for your company.*
- *We pride ourselves on our engineering expertise and technical ability working to international standards including ISO 9001, 14001 and 18001.*
- *Springfields has a long and successful history in the fuel cycle with over 40 years expertise in Hex conversion.*



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Hex Business at Springfields

Westinghouse

Hex Business

Modern nuclear reactor designs such as Pressurised Water and Light Water Reactors need nuclear fuel, made from Uranium Dioxide.

Uranium Hexafluoride (UF_6) is an essential intermediate product used in the manufacture of Uranium Dioxide fuels.

Meeting World Demands

The Springfields Hex facilities are capable of producing up to 5,500 tU of (UF_6) annually, incorporating the latest technology for safe, efficient and economic processing. The UF_6 produced is exported to enrichment facilities throughout the world in order to satisfy the requirements for nuclear fuel production.

UF_6 Production

Springfields UF_6 production is split into two key phases of its chemical conversion process. The first phase of the process occurs in the Rotary Kiln Plant converting Uranium Trioxide (UO_3) into Uranium Tetrafluoride (UF_4). The second phase occurs in Hex Plant, where UF_4 is converted to produce the desired chemical compound Uranium Hexafluoride (UF_6).
The Rotary Kiln Plant and Hex Plant will be explained in more detail on the following pages.

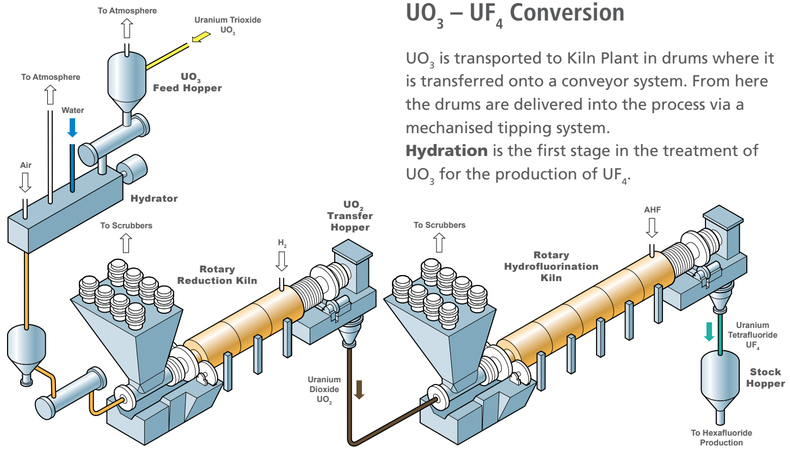
Advanced Technology

Both plants demonstrate proven and state-of-the-art technology. Automated handling facilities are incorporated for both product and waste streams which, when combined with secondary containment and advanced ventilation systems, lead to greatly reduced employee radiation exposure.

The plants are designed to be intrinsically safe, incorporating automatic shutdown and remote control as key features.

Equipment is supported on flexible mountings where necessary; to allow building movement and additional bracing is incorporated into the framework of the building for increased protection in the unlikely case of a seismic event.

Rotary Kiln Plant



UO_3 – UF_4 Conversion

UO_3 is transported to Kiln Plant in drums where it is transferred onto a conveyor system. From here the drums are delivered into the process via a mechanised tipping system.
Hydration is the first stage in the treatment of UO_3 for the production of UF_4.

UO_3 powder is fed into a hydrator where dilute nitric and sulphuric acids are added to increase the porosity of the powder and aid the chemical conversion process.

Reduction is the second stage in UF_4 production. UO_3 hydrate is fed into a hot rotating kiln and is gradually converted into UO_2 (Uranium Dioxide) in the presence of hydrogen gas. The main reactions in the reduction kiln can be split into two:

$UO_3.H_2O \rightarrow UO_3 + H_2O$ *This is the dehydration stage which is* ***endothermic.***
$UO_3 + H_2 \rightarrow UO_2 + H_2O$ *This is the reduction stage which is* ***exothermic.***

Hydrofluorination is the third stage. The UO_2 powder is fed into a hot rotating kiln and is gradually converted into UF_4 by reaction with gaseous hydrogen fluoride.

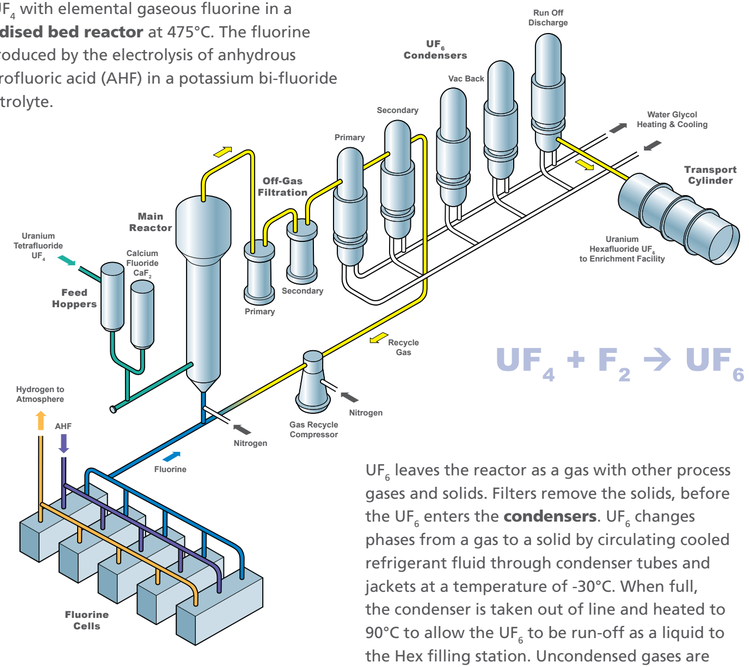
$UO_2 + 4HF \rightarrow UF_4 + 2H_2O$ *This reaction is* ***exothermic.***

Once converted, UF_4 is transported to stock hoppers where it is held temporarily before being pneumatically transported via pipe line to the Hex Plant.

Hex Plant

UF_4 – UF_6 Conversion

Uranium Hexafluoride is produced by the reaction of UF_4 with elemental gaseous fluorine in a **fluidised bed reactor** at 475°C. The fluorine is produced by the electrolysis of anhydrous hydrofluoric acid (AHF) in a potassium bi-fluoride electrolyte.



UF_6 leaves the reactor as a gas with other process gases and solids. Filters remove the solids, before the UF_6 enters the **condensers**. UF_6 changes phases from a gas to a solid by circulating cooled refrigerant fluid through condenser tubes and jackets at a temperature of -30°C. When full, the condenser is taken out of line and heated to 90°C to allow the UF_6 to be run-off as a liquid to the Hex filling station. Uncondensed gases are recycled back to the reactor.

At the **filling station** a Hex cylinder is connected to a pipeline from the condensers within a secondary containment area. Once filled the cylinders are left to cool where the Hex solidifies and creates a vacuum. The UF_6 is now ready to be transported to enrichment plants around the world.


hex plant complex


hex transport cylinders

visitors information area


UO_3 drum tipper facility


kiln deck


UF_4 stock hopper area


fluorine cell room


condenser room


control room