Uranium Enrichment

Natural Uranium and U^{235} constituent

Mixture of two isotopes of uranium constitute Natural uranium. In this **only 0.7%** uranium is fissile material that is U^{235} reminder is U^{238}. For nuclear reactor use U^{238} is not suitable because it is not a fissionable material. Hence the natural uranium has to be processed for conversion and enriched for reactor usage. This enrichment process produces U^{235} between 3.5 % and 5 % by removing 85% of U^{238} .

Process involved in obtaining U^{235} for fission activity

To obtain U^{235} Gaseous Uranium hexafluoride is separated in two streams . One stream is enriched to certain level of low enriched uranium. Another stream is depleted progressively the $U^{238}$from UF_6 Gaseous Uranium hexafluoride and extract U^{235} and it is called as tails.

Yellow cake of hexafluoride UF_6 is dissolved in nitric acid and a series of chemical processes will be done before making it as a gas uranium hexafluoride by heating greater than 64 degree centigrade. This process is done to (enrich) increase the U^{235} atom.

Radioactive Uranium and conversion

The product we get from uranium mill is not usable directly in nuclear reactors as yellow cake consist of radioactive 80% uranium. During the conversion of pure uranium hexafluoride for enrichment operation the impurities also removed . Now the uranium is combined with fluorine to create UF_6 gas. Then pressurised and cooled to a liquid. In liquid state it is drained into cylinder and kept for 5 days in cooling for solidification. Now the UF_6 gas in solid form in cylinder is shipped to enrichment plant. UF_6 gas is the only uranium compound exist as gas in a suitable temperature.

Enrichment Process in Large Scale

There are three enrichment process being used to enrich the natural uranium. They are 1. Gaseous Diffusion 2. Gas centrifuge 3. Thermal diffusion

Safety measures in conversion plant

The Uranium hexafluoride is corrosive and reactive. So it should be handled carefully. Hence pipe and pumps at conversion plant should specially constructed from aluminium and nickel alloys. These cylinders are kept away from oil and grease lubricants to avoid inadvertent chemical reactions.

Risk factors during mining and milling.

The primary risks in conversion during mining ,milling are chemical and radiological in nature of yellow cake the hexafluoride. Strong acids and alkalis are used in conversion process and there is a chance for yellow cake the hexafluoride powder to soluble form that leads to inhalation of uranium. Also conversion process produces extremely corrosive chemicals that may catch fire and explosion.