Nuclear Families

– an extension to is it DU, NU, LEU or HEU

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Uranium is usually categorised by isotopics as either:

- **Depleted Uranium**
- **Natural Uranium**
- **Low Enriched uranium**
- **High Enriched uranium**

Type	% U-235
DU	< 0.72
NU	0.72
LEU	>0.72, <20
HEU	>20

Uranium can be characterised by the analysis of all the isotopes present.

Natural Uranium Isotopics, %			
U-234	U-235	U-236	U-238
0.0054	0.7204	~1 x 10^{-11}	99.2742

A major proportion of the worlds processed uranium has been irradiated in nuclear reactors as fuel or blankets:

- **Irradiated Depleted Uranium, IrDU**
- **Irradiated Natural Uranium, IrNu**
- **Irradiated Low Enriched Uranium, IrLEU**
- **Irradiated High Enriched Uranium, IrHEU**

The effect of irradiation is

- **to reduce U-234 concentration by conversion to U-235,**
- **to reduce U-235 concentration by fission and conversion to U-236,**
- **to increase U-236 concentration by conversion of U-235**
- **to reduce U-238 concentration by conversion to Pu-239**

Due to the presence of highly active fission products this material is not in circulation.

A significant proportion of the irradiated fuel has been reprocessed.

Leads to 4 extra categories:

- **Reprocessed Irradiated Depleted Uranium, ReproDU**
- **Reprocessed Irradiated Natural Uranium, ReproNU**
- **Reprocessed Irradiated Low Enriched Uranium, ReproLEU**
- **Reprocessed Irradiated High Enriched Uranium, ReproHEU**

Should therefore be possible to categorise uranium into 8 categories

– the starting materials, and the reprocessed materials.

Irradiation and reprocessing cycles can be repeated several times, including re--enrichment.
Where this has happened U-236 contaminates the manufacturing plants allowing U-236 to be detected in any new uranium entering the fuel cycle – called perfuming.

It is very difficult to find any uranium isotopic data in the open literature that is U-236 free.
The world supply of uranium has been well perfumed. This, together with the extensive use of blending in the nuclear industry, makes the study of uranium isotopic fingerprints very complex.

URANIUM ISOTOPE PLOTS USING DATA FROM THE OPEN LITERATURE