Thorium (Th)

**Element classification:** Actinide

**No. of isotopes:** 26

**Typical elemental concentrations:**
- Soil (dry): 6 mg/kg (2-12 mg/kg)
- Sea water: 0.001 µg/L
- Fresh water: 0.03 µg/l

**Behavior in the Environment**
- Present naturally in soil, rock and water (as part of the U and Th natural decay series)
- Strongly binds to bottom sediments and suspended solids in water; One of the largest $K_d$ of all radionuclides
- Exists as $\text{Th}^{4+}$ in soils and waters, and is the largest tetravalent cation (ionic radius 1 Å)
- Isotopes and isotope ratios can be used to study ecosystem processes (e.g., dating, marine sedimentation flux)
- Important mining sources

**Key sources of radioisotopes**
- **Nuclear cycle:** Nuclear power plants, reprocessing, waste
- **Natural sources:** Yes
- ** Fallout:** No
- **Others:** Gas mantle (industrial) and thorotrast medical
- **Nuclear accidents:** No

**Why is it of interest?**
- It is a naturally occurring element; enriched in certain minerals (e.g., monazite).
- $^{232}\text{Th}$ (13.9 Gyr) heads one of the three natural decay chains, with a number of dose-contributing daughters
- Radio and chemically toxic
- Potential fuel for new generation nuclear reactors

For more information ...

- IRSN Th factsheet
- IRSN Th health sheet

www.radioecology-exchange.org