The Use of Thorium as Nuclear Fuel

Position Statement
November 2006

The American Nuclear Society endorses continued research and development of the use of thorium as a fertile[a] fuel material for nuclear reactors. Thorium is a potentially valuable energy source since it is about three to four times as abundant in the earth's crust as uranium and is a widely distributed natural resource, which is readily accessible in many countries.[1]

Use of thorium as a fertile fuel material leads to the following:

- production of an alternative fissile uranium isotope, uranium-233
- coproduction of a highly radioactive isotope, uranium-232, which provides a high radiation barrier to discourage theft and proliferation of spent fuel.

The path to sustainability of nuclear energy in several countries, notably India, profits from technology that utilizes their vast thorium resources. Waste produced during reactor operations benefits from the fact that the thorium-uranium fuel cycle does not readily produce long-lived transuranic elements. To date thorium utilization has been demonstrated in light water reactors,[2] as well as in other reactor types[3] including fast spectrum reactors, heavy water reactors, and gas-cooled reactors. In this context, the database and experience with thorium fuel and fuel cycles are very limited and must be augmented significantly before large-scale investment is committed to commercialization.

Since thorium is an abundant resource that can potentially be used as a fertile nuclear fuel, it is likely to be an important contributor to the future global nuclear enterprise in several countries. It is, therefore, paramount that the evolving global thorium fuel cycle (including fuel conditioning and recycling operations) incorporate the latest in safeguards and other proliferation-resistant design features so that the thorium fuel cycle complements the uranium fuel cycle and enhances the long-term global sustainability of nuclear energy.

---

[a] "Fertile" fuel materials (special isotopes that will not support a nuclear chain reaction) may be changed into "fissile" fuel materials (isotopes that will support a nuclear chain reaction) by neutron irradiation in a nuclear reactor.

References
1. "Thorium Fuel Cycle—Potential Benefits and Challenges," IAEA-TECDOC-1450, International Atomic Energy Agency.
2. "Fuel Summary Report: Shippingport Light Water Breeder Reactor," INEEL/EXT-98-00799, Idaho National Engineering and Environmental Laboratory.
3. "Thorium Fuel Utilization: Options and Trends," IAEA-TECDOC-1319, International Atomic Energy Agency; see also "Thorium Based Fuel Options for the Generation of Electricity: Developments in the 1990s," IAEA-TECDOC-1155, International Atomic Energy Agency.
