

Union of Concerned Scientists Statement on Thorium-fueled Reactors

Some people advocate the use of thorium to fuel nuclear power plants. Thorium could be used in a variety of different types of reactors, including conventional light-water reactors, which are the type used in the United States. However, thorium cannot be used by itself to sustain a nuclear chain reaction: it must be used together with a fissile material such as enriched uranium, uranium-233, or plutonium.

Nuclear reactors fueled with thorium and uranium do not provide any clear overall advantages over reactors fueled with uranium alone. All types of nuclear fuels, whether uranium- or thorium-based, generate large amounts of heat during reactor operation, and failing to effectively remove that heat will lead to serious safety problems, as was seen at Fukushima. The U.S. Department of Energy has concluded after a review that “the choice between uranium-based fuel and thorium-based fuel is seen basically as one of preference, with no fundamental difference in addressing the nuclear power issues [of waste management, proliferation risk, safety, security, economics, and sustainability].”¹ However, the report also notes that “Since no infrastructure currently exists in the U.S. for thorium-based fuels, and the processing of thorium-based fuels is at a lower level of technical maturity when compared to processing of uranium-based fuels, costs and RD&D [research, development and deployment] requirements for using thorium are anticipated to be higher.”

Some people believe that liquid fluoride thorium reactors, which would use a high-temperature liquid fuel made of molten salt, would be significantly safer than current-generation reactors. However, such reactors have major flaws. There are serious safety issues associated with the retention of fission products in the fuel, and it is not clear these problems can be effectively resolved. Such reactors also present proliferation and nuclear terrorism risks because they involve the continuous separation, or “reprocessing,” of the fuel to remove fission products and to efficiently produce U-233, which is a nuclear weapon-usable material. Moreover, disposal of the used fuel has turned out to be a major challenge. Stabilization and disposal of the remains of the very small “Molten Salt Reactor Experiment” that operated at Oak Ridge National Laboratory in the 1960s has turned into the most technically challenging cleanup problem that Oak Ridge has faced, and the site has still not been cleaned up.

¹ Roald Wigeland et al, “AFCI Options Study,” Idaho National Laboratory, INL/EXT-10-17639, September 2009. Available at <http://www.inl.gov/technicalpublications/Documents/4480296.pdf>