Liquid-Fluoride Thorium Reactor Technology

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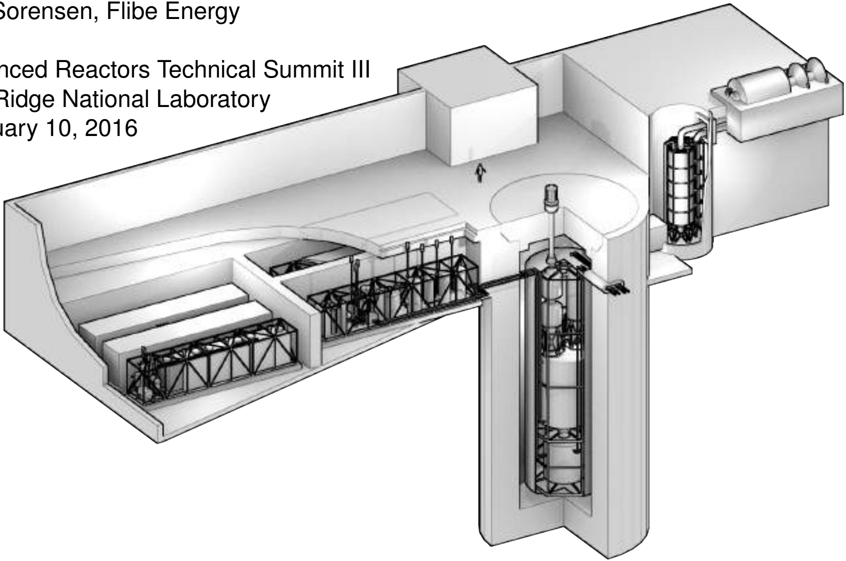
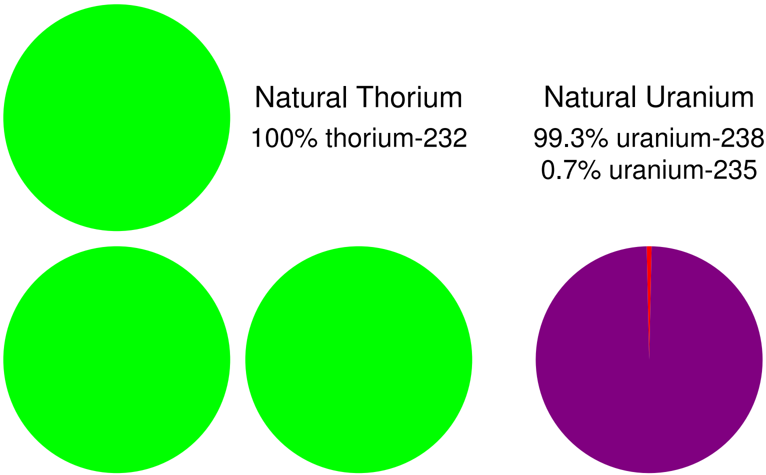
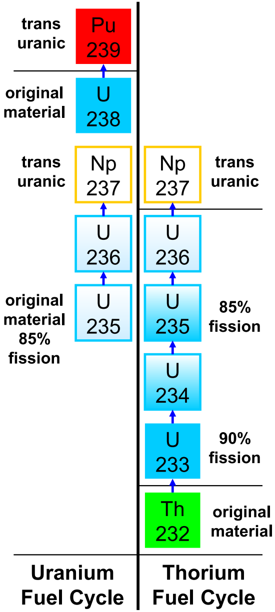


Possible Nuclear Fuels

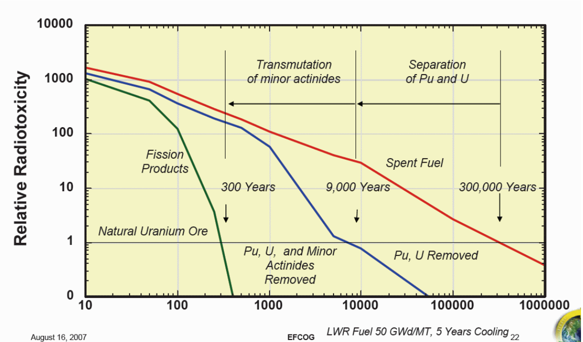


Only a small fraction of natural uranium is fissile. Most uranium and all thorium is "fertile" and can be converted to fissile material through neutron absorption.

Reducing Long-Lived Waste

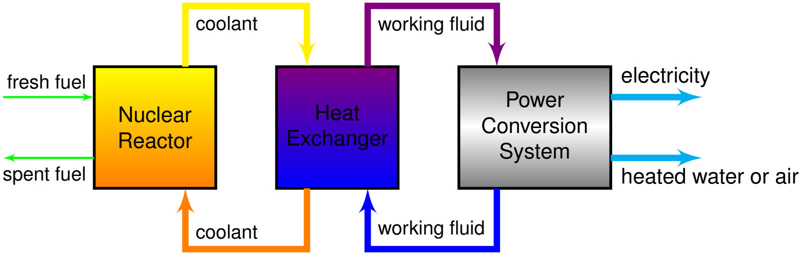


- Today's approach to nuclear energy consumes only a small amount of the energy content of uranium while producing "transuranic" nuclides that complicate long-term waste disposal.
- Using thorium/U-233 in a liquid-fueled reactor can more nearly approach the ideal of a fission-product-only waste stream that reaches the same radioactivity as uranium ore in 300 years.



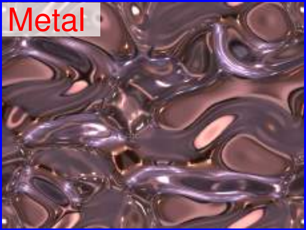
Fundamental Nuclear Reactor Concept

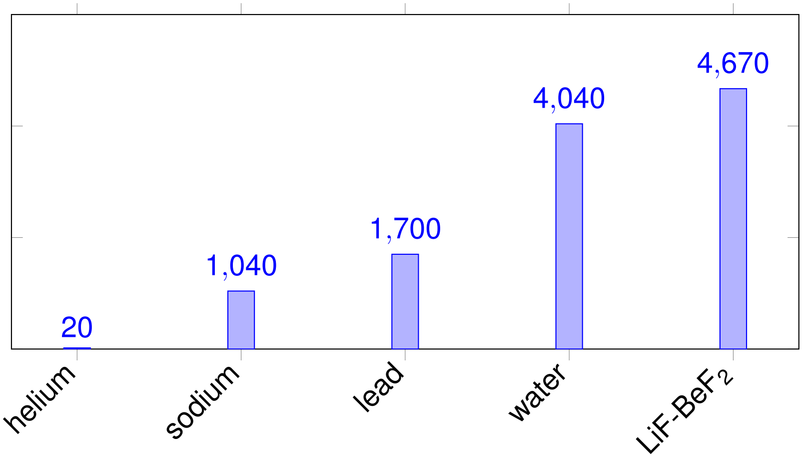
In its simplest form, a nuclear reactor generates thermal energy that is carried away by a coolant. That coolant heats the working fluid of a power conversion system, which generates electricity from part of the thermal energy and rejects the remainder to the environment.



The primary coolant chosen for a nuclear reactor determines, in large part, its size and manufacturability. The temperature of the coolant determines the efficiency of electrical generation.

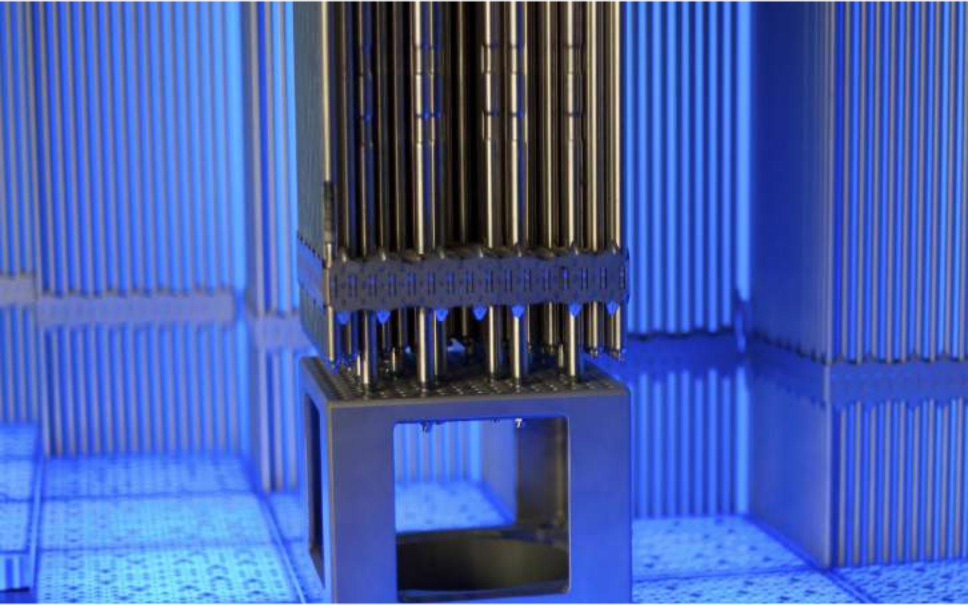
Coolant Choices for a Nuclear Reactor

	atmospheric pressure operation	high-pressure operation
moderate temperature (250-450°C)	Metal 	Water 
high temperature (650-900°C)	Salt 	Gas 



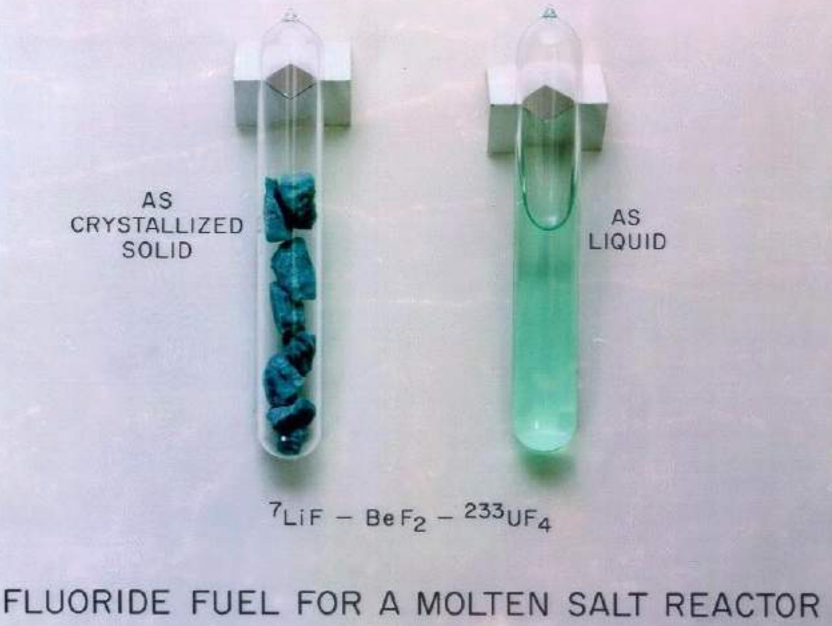
A fluoride salt mixture (LiF-BeF$_2$) has the greatest volumetric heat capacity of any coolant option. Volumetric heat capacity is a basic “yardstick” in reactor sizing.

Today’s nuclear fuel is fabricated with extraordinary precision, like a fine watch.

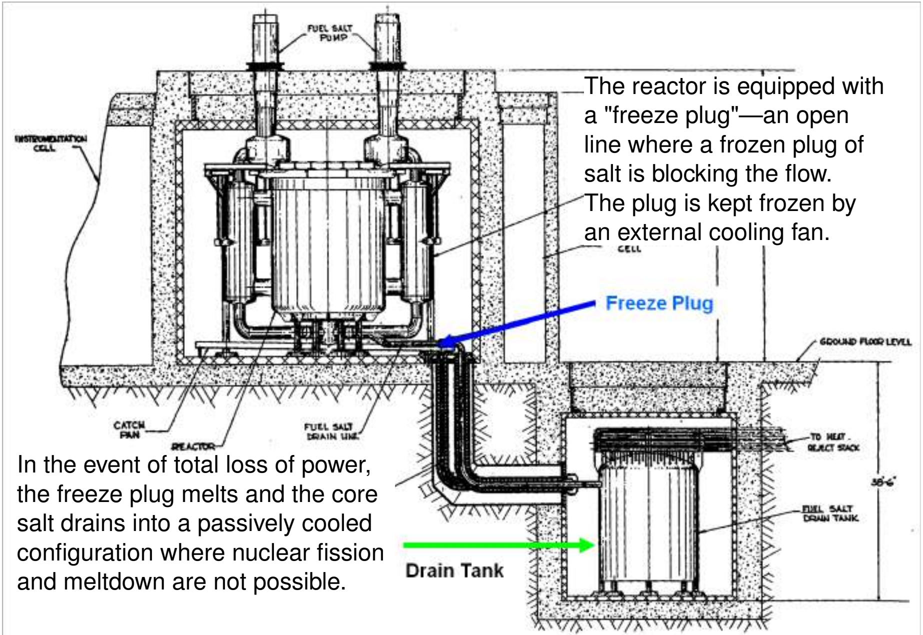


But it is that precision that makes it difficult to recycle and to refabricate. A new approach is needed that is more versatile and less expensive.

LiF-BeF_2 fluoride salt is an excellent carrier for uranium (UF_4) nuclear fuel.



Liquid fuels enhance safety options

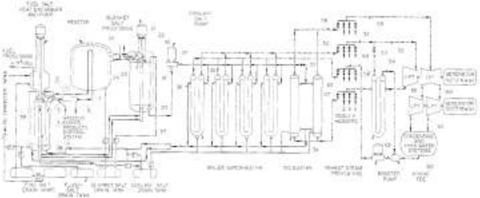


The reactor is equipped with a "freeze plug"—an open line where a frozen plug of salt is blocking the flow. The plug is kept frozen by an external cooling fan.

In the event of total loss of power, the freeze plug melts and the core salt drains into a passively cooled configuration where nuclear fission and meltdown are not possible.

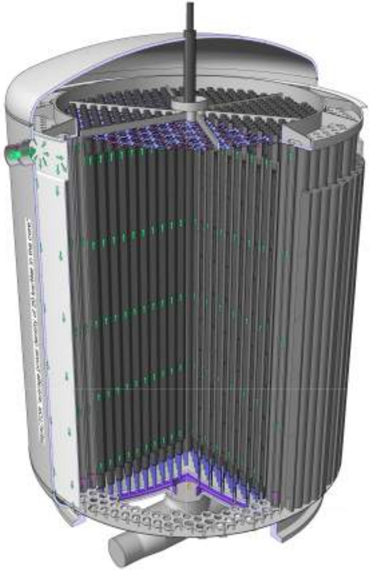
Thorium Reactor Technology

Historical Concepts



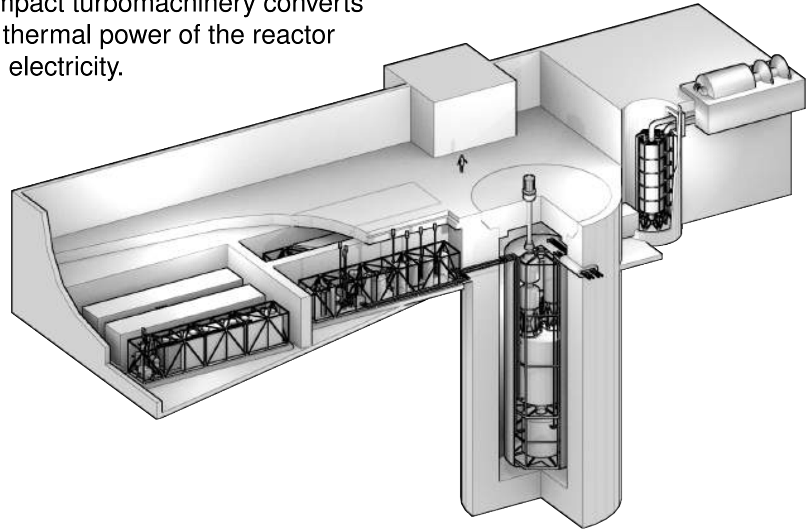
Hardware Demonstrations

Modern Designs



250 MWe LFTR facility concept

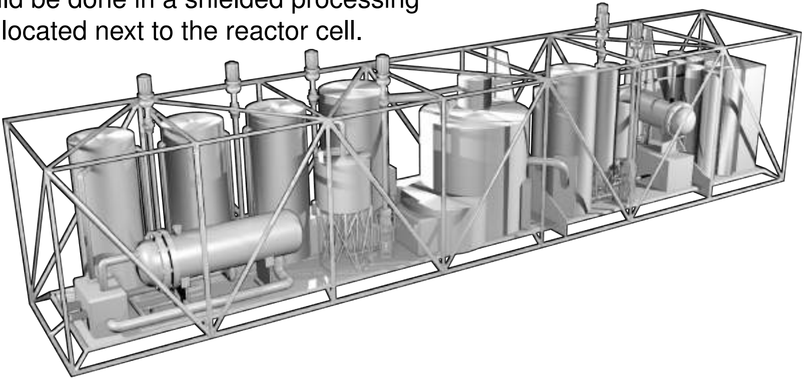
Compact turbomachinery converts the thermal power of the reactor into electricity.



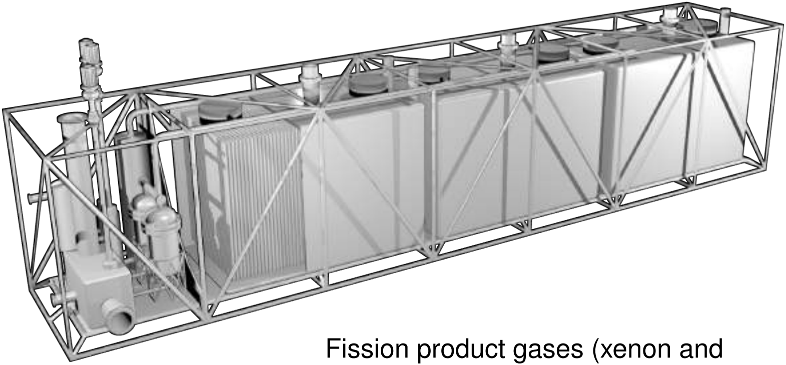
The reactor cell is located below ground in a shielded containment structure.

LFTR chemical processing concept

Chemical processing of the fluoride salts would be done in a shielded processing cell located next to the reactor cell.

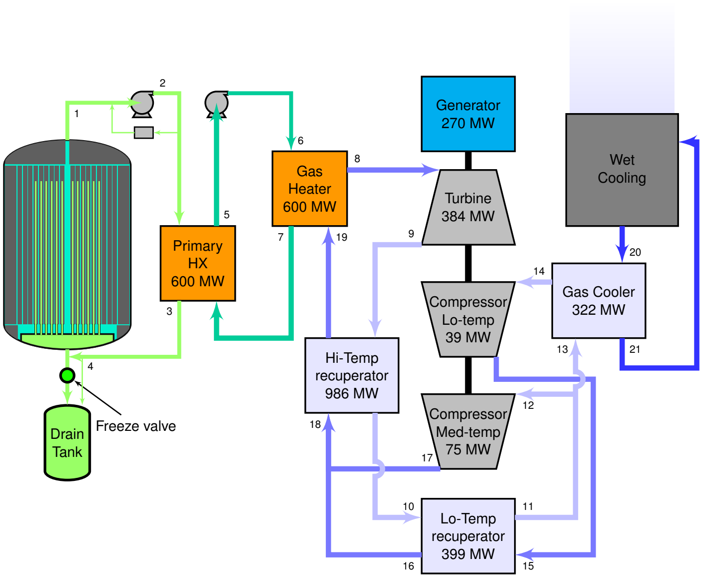


LFTR offgas handling concept



Fission product gases (xenon and krypton) would be held up until they decayed to stable isotopes in a shielded cell close to the reactor cell.

250 MWe LFTR power conversion system



Flibe Energy was formed in order to develop liquid-fluoride reactor technology and to supply the world with affordable and sustainable energy, water and fuel.