

MOLTEN SALT REACTORS AND THORIUM: A NEW ALTERNATIVE FOR NUCLEAR ENERGY



History and Background of Nuclear Energy:

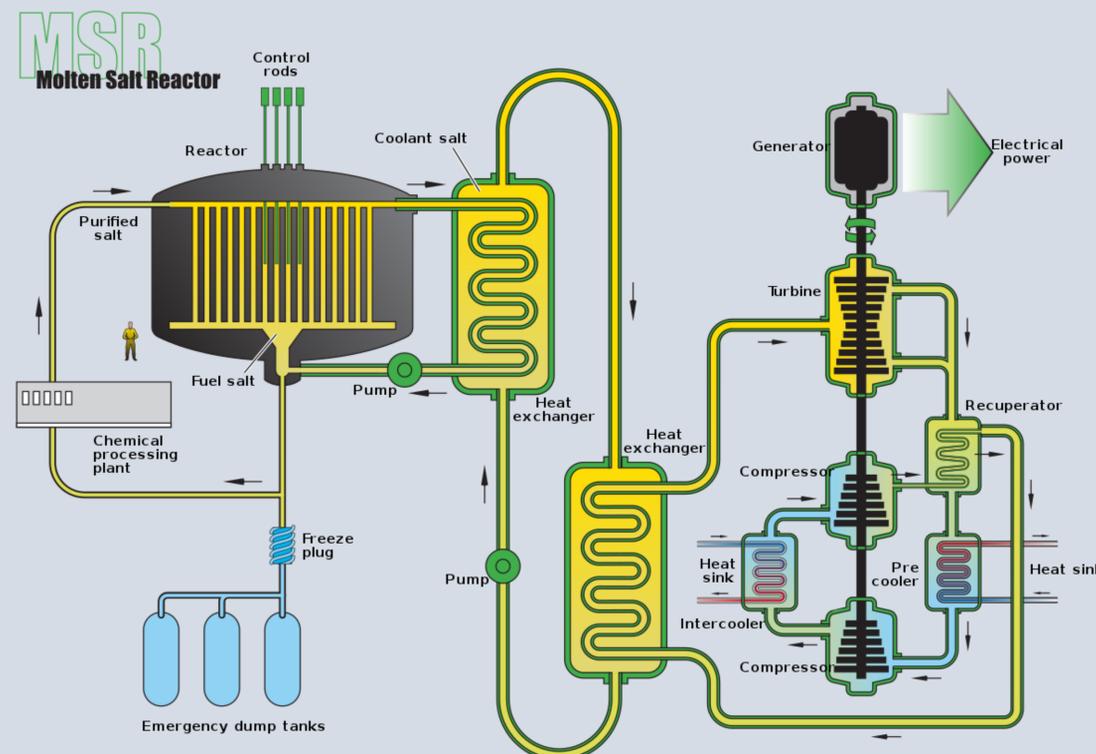
Lise Meitner discovered that when the nucleus of an atom was split, there was a loss of mass in the products. This led to the conclusion that the mass lost in nuclear fission resulted in the creation of energy, beginning an era of atomic research. This research inspired a range of nuclear designs and applications, including nuclear weapons due to the conflicts of World War II. The by-products of specific nuclear reactors could be easily used in nuclear weapons, making these designs more favorable over others. This left many nuclear reactor designs unexplored, including the molten salt reactor.

Overview of Molten Salt Reactors (MSRs):

Despite nuclear accidents, nuclear reactors have the least amount of associated deaths in comparison to other sources of energy. Not only is nuclear energy a better alternative to nonrenewable forms of energy (i.e. coal or oil), but a single design, the MSR, stands out among others. In comparison to other nuclear reactor designs, the MSR is safer, more accessible, and possibly a solution to preventing climate change, making it a viable replacement of other forms of energy.

How It Works:

- Fuel is piped into the reactor and generates heat through fission (split of an atomic nucleus)
- By-products are filtered out of the heated fuel and fuel is pumped into the heat exchanger
- Salt coolant absorbs heat from the fuel, cooling it so it can be pumped back into the reactor
- Heat from salt coolant is used to boil water (create steam) to run turbines
- Turbines generate electricity



Benefits of MSRs:

- ✓ No nuclear meltdowns
 - The most common nuclear accidents are nuclear meltdowns, which is when the solid fuel of a reactor melts and can escape outside of the reactor with the coolant. MSRs have fuel that is already in liquid form and designed to run with such.
- ✓ No risk of runaway heating
 - Solid fuel reactors can reach dangerous levels of heating. MSRs actually run the risk of the salt fuel freezing, which is solved by an internal furnace.
- ✓ No accidents from loss of power
 - Many nuclear accidents are a result of power loss, which would interfere with the function of coolant pumps that control the nuclear fission. MSRs have a fan that keeps the plug to a catch basin cool and in the event of power loss, the fan will not run and simply allow the reaction to stop without any human intervention.
- ✓ Thorium is an abundant fuel
 - Uranium is the most common fuel element used in modern nuclear reactors and is rare in comparison to other elements. Thorium, on the other hand, is very common globally and is the main element in the fuel for MSRs.
- ✓ More eco-friendly nuclear waste
 - Current nuclear reactor waste is not being used as quickly as during WWII for nuclear weapons and is getting more difficult to dispose of due to the lack of planning. MSRs naturally bubble out most of the toxins from the fuel and the radioactive waste has a much lower half-life than that of other reactor waste, meaning that the fuel will decay faster.