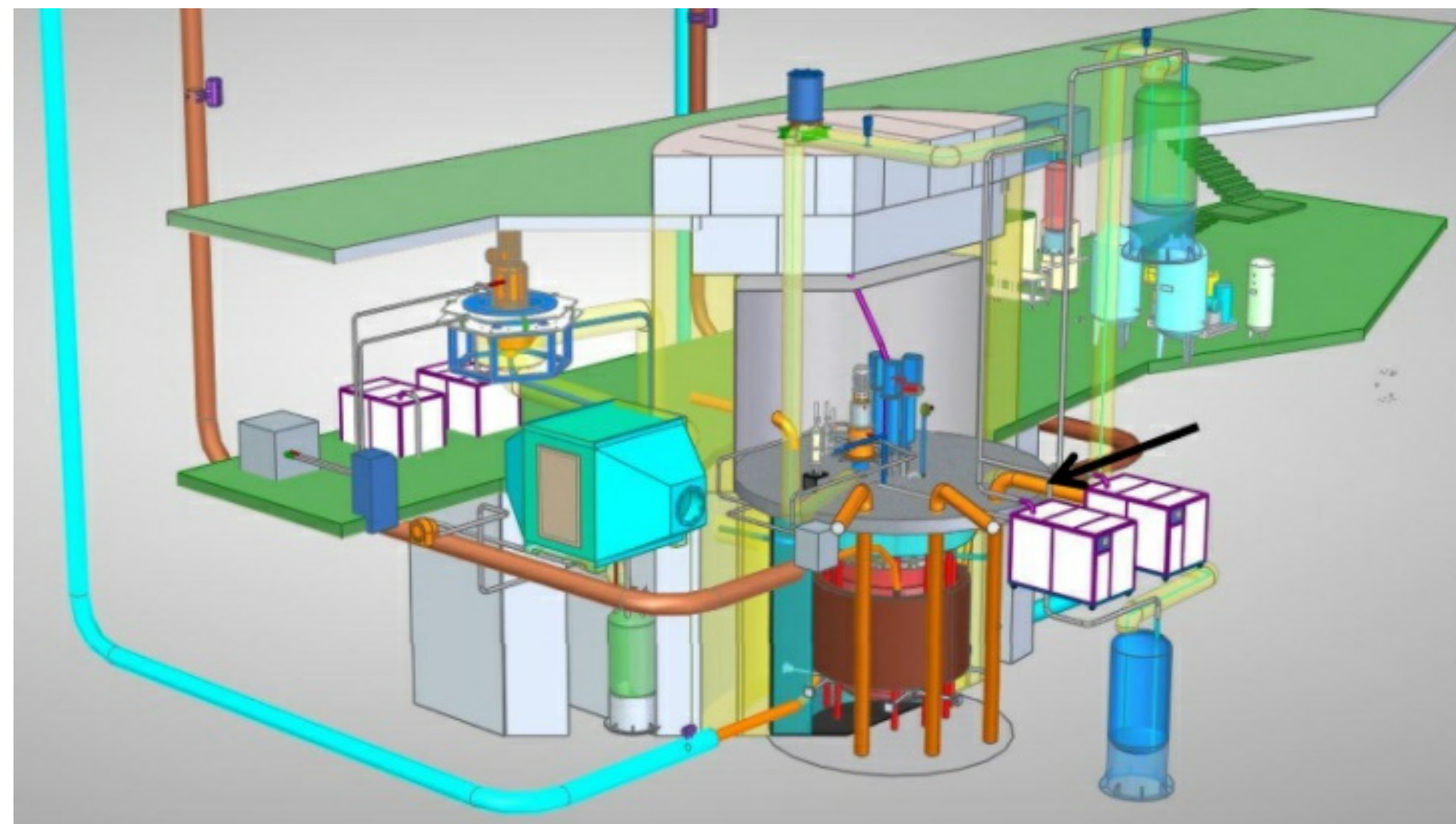


Chinese molten-salt reactor cleared for start up

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The Shanghai Institute of Applied Physics (SIAP) - part of the Chinese Academy of Sciences (CAS) - has been given approval by the Ministry of Ecology and Environment to commission an experimental thorium-powered molten-salt reactor, construction of which started in Wuwei city, Gansu province, in September 2018.



A cutaway of the TMSR-LF1 reactor (Image: SIAP)

In January 2011, CAS launched a CNY3 billion (USD444 million) R&D programme on liquid fluoride thorium reactors (LFTRs), known there as the thorium-breeding molten-salt reactor (Th-MSR or TMSR), and claimed to have the world's largest national effort on it, hoping to obtain full intellectual property rights on the technology. This is also known as the fluoride salt-cooled high-temperature reactor (FHR). The TMSR Centre at SIAP at Jiading, Shanghai, is responsible.

Construction of the 2 MWt TMSR-LF1 reactor began in September 2018 and was reportedly completed in August 2021. The prototype was scheduled to be completed in 2024, but work was accelerated.

"According to the relevant provisions of the Nuclear Safety Law of the People's Republic of China and the Regulations of the People's Republic of China on the Safety Supervision and Administration of Civilian Nuclear Facilities, our bureau has conducted a technical review of the application documents you submitted, and believes that your 2 MWt liquid fuel thorium-based molten salt experimental reactor commissioning plan (Version V1.3) is acceptable and is hereby approved," the Ministry of Ecology and Environment told SIAP on 2 August.

It added: "During the commissioning process of your 2 MWt liquid fuel thorium-based molten salt experimental reactor, you should strictly implement this plan to ensure the effectiveness of the implementation of the plan and ensure the safety and quality of debugging. If any major abnormality occurs during the commissioning process, it should be reported to our bureau and the Northwest Nuclear and Radiation Safety Supervision Station in time."

The TMSR-LF1 will use fuel enriched to under 20% U-235, have a thorium inventory of about 50 kg and conversion ratio of about 0.1. A fertile blanket of lithium-beryllium fluoride (FLiBe) with 99.95% Li-7 will be used, and fuel as UF4.

The project is expected to start on a batch basis with some online refuelling and removal of gaseous fission products, but discharging all fuel salt after 5-8 years for reprocessing and separation of fission products and minor actinides for storage. It will proceed to a continuous process of recycling salt, uranium and thorium, with online separation of fission products and minor actinides. The reactor will work up from about 20% thorium fission to about 80%.

If the TMSR-LF1 proves successful, China plans to build a reactor with a capacity of 373 MWt by 2030.

As this type of reactor does not require water for cooling, it will be able to operate in desert regions. The Chinese government has plans to build more across the sparsely populated deserts and plains of western China, complementing wind and solar plants and reducing China's reliance on coal-fired power stations. The reactor may also be built outside China in Belt and Road Initiative nations.

The liquid fuel design is descended from the 1960s Molten-Salt Reactor Experiment at Oak Ridge National Laboratory in the USA.

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