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第11回GIF-LFR pSSC
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米側発表資料　C. F. Smith

LMFR Development: status and perspectives in the USA

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Short Summary for meeting of GIF-LFR-PSSC

April 16th, 2012

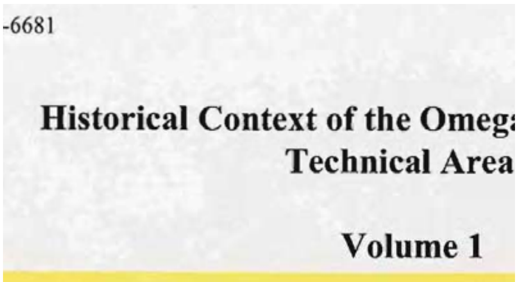
Pisa, Italy

Outline of comments

- Historical backdrop: LMFR's
- LFR Activities: current status
- Closing comments

US Fast Reactor: A Rich Historical Context

- **Clementine:** the first fast reactor, built by LANL in 1946. Pu-fueled, mercury-cooled, 25Wt power.
- **EBR-1:** the first reactor to generate electrical power, built in 1949-51 at Idaho Falls. NaK-cooled, 1.4 MWt, decommissioned in 1964. First breeder reactor.
- **Fermi-1:** 94MWe FBR prototype, built near Detroit in 1957, operated until 1972. Sodium cooled.
- **LAMPRE:** 1 MWt FR based on molten Pu fuel, sodium cooling, and reflector control, built at LANL in the 1957-61 time frame.
- **EBR-II:** sodium cooled 62 MWt reactor, built in Idaho as the IFR prototype in 1965; operated for 30 years.
- **SEFOR:** Experimental test reactor operated from 1969 to 1972 in Arkansas. MOX-fueled, Na-cooled, 20 MWt.
- **FFTF:** Built in 1978 in Washington State, 400 MWt Na-cooled test reactor.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Historical Context of the Omeg
Technical Area

Volume 1

Clementine
1946

EBR-1
1951

Fermi-1
1957

EBR-2
1965

SEFOR
1972

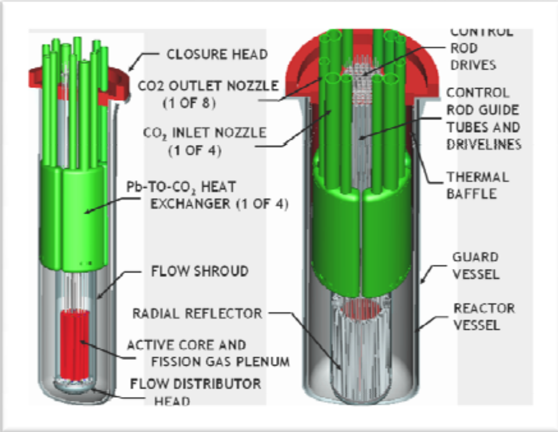
FFTF
1978

LFR Activities in the US

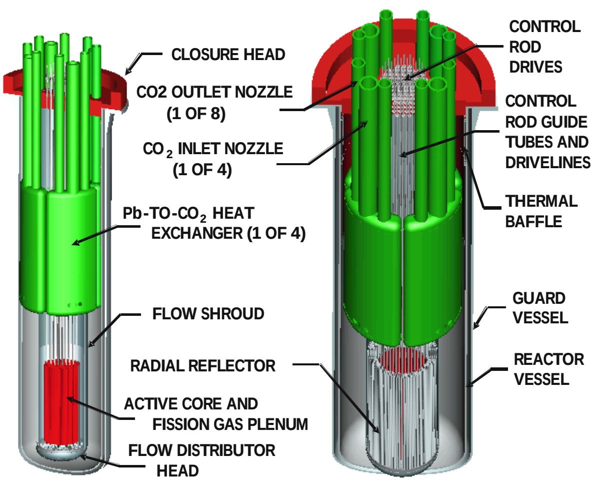
LFR activities in the US have been relatively limited in the past year+

Continuing (though mainly small) efforts include:

- Work at US national laboratories
- University efforts
- Some US industrial efforts
- SSTAR as a GIF reference concept for a small, transportable LFR



The Small Secure Transportable Autonomous Reactor (SSTAR)



SSTAR is a small natural circulation fast reactor of 20 MWe/45 MWt, that can be scaled up to 180 MWe/400 MWt.

The compact active core is removed by the supplier as a single cassette and replaced by a fresh core.

Key technical attributes include the use of lead (Pb) as coolant and a long-life sealed core in a small, modular system.

SSTAR Reactor Core Parameters

Coolant	**Lead**
Fuel	**Transuranic Nitride, Enriched in N_{15}**
Enrichment, %	**5 Radial Zones, TRU/HM 1.7/3.5/ 17.2/19.0/20.7**
Core Lifetime, years	**30**
Core Inlet/Outlet Temperature, ºC	**420/567**
Coolant circulation	**Natural convection**
Average (Peak) Discharge Burnup, MWd/Kg HM	**81(131)**

Peak Fuel Temperature, ºC	**841**
Peak Cladding Temperature, ºC	**650**
Fuel Pin Diameter, Cm	**2.50**
Fuel/Coolant Volume Fractions	**0.45/0.35**
Active Core Dimensions, Height/Diameter, m	**0.976/1.22**
Power conversion	**$S\text{-}CO_2$ Brayton cycle**

Continuing LFR Activities in the US

Efforts at US national labs

- LLNL support to DOE’s Advanced Reactor program
- ANL completion of work on the ‘SUPERSTAR’ concept, an extension of the SSTAR concept
- LANL work with MIT and with UC Berkeley on material testing and performance.


System Research Plan for the Lead-cooled Fast Reactor (LFR)

Final Draft, 4 April 2008

NOTE: DRAFT SYSTEM RESEARCH PLAN (SRP) FOR THE LEAD-COOLED FAST REACTOR (LFR).

It has been assembled by the LFR Provisional System Steering Committee (PSSC) following formal committee meetings and informal working sessions. It should be considered a work-in-progress. It is being made available outside the PSSC for review and feedback. Note that the section on fuels draws from the parallel efforts of the SFR-SSC. Comments and feedback will be welcome. Reviewers should note the following key features of the proposed plan: (1) the plan takes a dual track (with a small transportable system and a moderate or large central station system); and (2) the plan suggests a single demonstration facility to serve both tracks.

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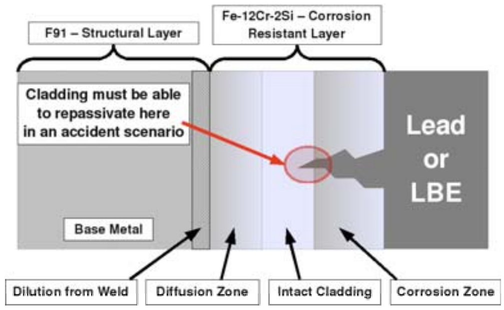
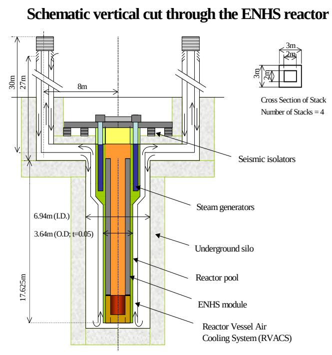
Issued by the

Continuing LFR Activities in the US

- University efforts
  - MIT work on Functionally Graded Composite materials
  - UC Berkeley material science and LFR design work
  - UNLV operation of an LBE loop

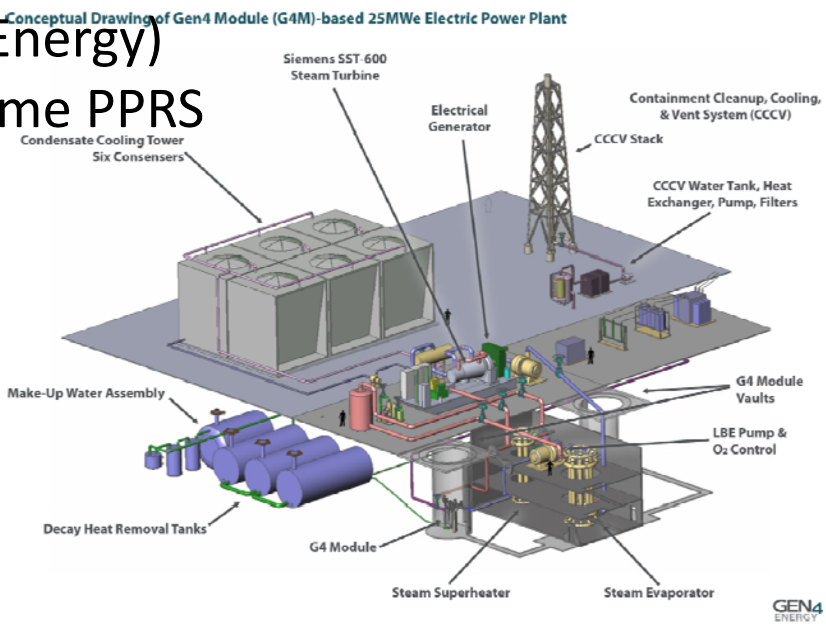




Continuing LFR Activities in the US

Some limited industrial efforts in the US

- Hyperion Power Group (HPG) (now Gen-4 Energy)
- lakeChime PPRS



Concluding comments

- In spite of a rich history in LMFR development, current US efforts are limited
- Nevertheless, there is some interest in LFR technology, mainly as a backup option to the SFR
- A small but dedicated group of researchers are continuing to maintain options through national lab, university and industry projects.