

Profile SFR-51

SAPFIRE

JAPAN

GENERAL INFORMATION

NAME OF THE FACILITY
ACRONYM
COOLANT(S) OF THE FACILITY
LOCATION (address):
OPERATOR
CONTACT PERSON
(name, address, institute, function, telephone, email):

SAPFIRE
SAfety Phenomenology tests on sodium leak, FIREs and aerosols
Sodium
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STATUS OF THE FACILITY
Start of operation (date):

In operation
1985

MAIN RESEARCH FIELD(S)

- Zero power facility for V&V and licensing purposes
- Design Basis Accidents (DBA) and Design Extended Conditions (DEC)
- Thermal-hydraulics
- Coolant chemistry
- Materials
- Systems and components
- Instrumentation & ISI&R

TECHNICAL DESCRIPTION

Description of the facility

The SAPFIRE facility consists mainly of a cylindrical steel vessel SOLFA-2 with the inner volume of about 100 m³ and a cylindrical steel vessel FRAT-1 with the inner volume of about 3 m³. Both the vessels are used to investigate event progression and thermal consequences of

sodium leak and fire behaviours. Other systems and components in the facility are sodium storage tank, sodium heater, gas supplying system, and gas exhausting and liquid wasting system with water scrubber.

Acceptance of radioactive material

No

Scheme/diagram

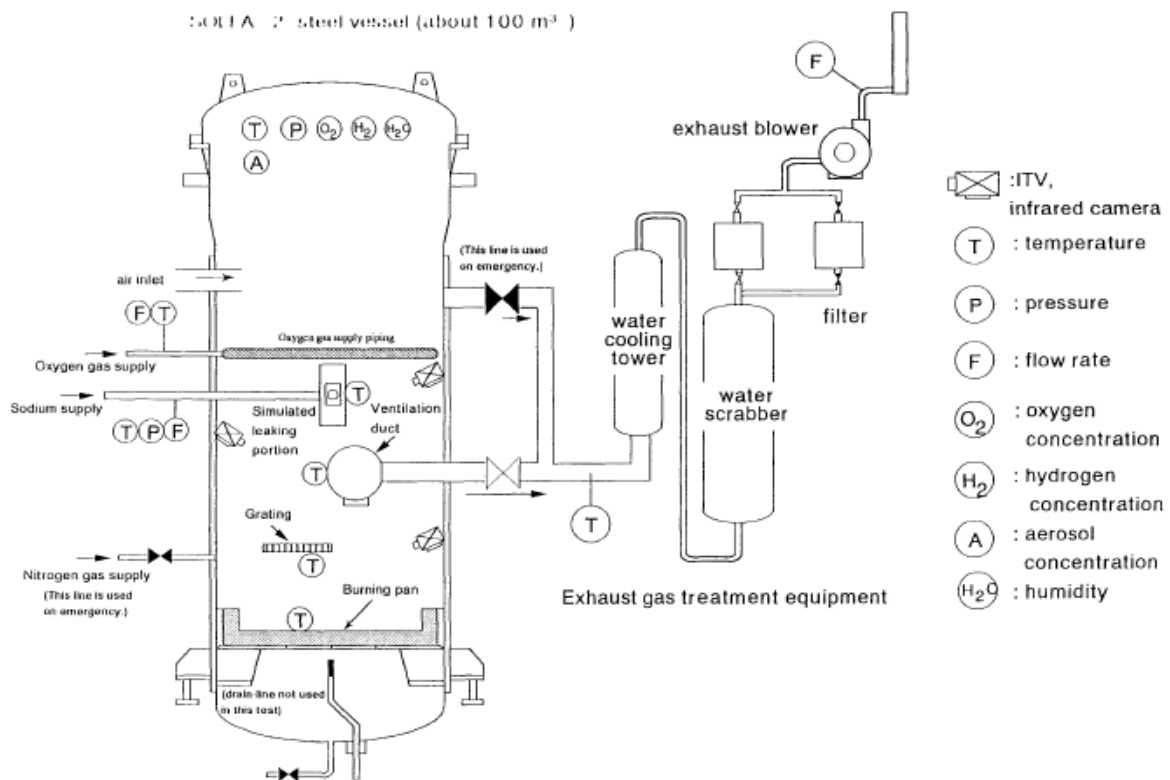


FIG. 1. Flow diagram for SOLFA-2 Test Apparatus

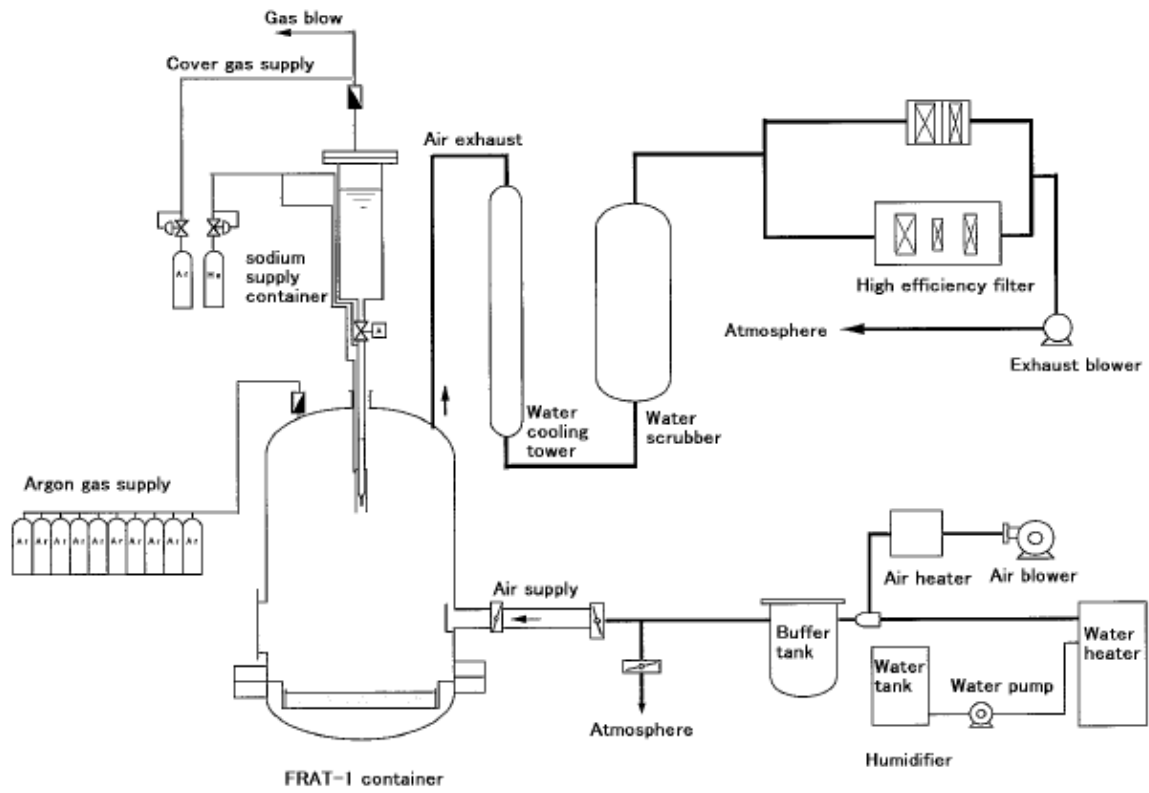


FIG. 2. Flow Diagram for FRAT-1 Test Apparatus

3D drawing/photo



FIG. 3. SOLFA-2 test vessel

Parameters table

Coolant inventory	Max. sodium inventory: 15180 kg
Power	-
Test sections	
TS #1 (SOLFA-2) TS #2 (FRAT-1)	<u>Characteristic dimensions</u> TS #1: 3.6 m inner diameter, 10.8 m height TS #2: 1.3 m inner diameter, 2.2 m height
	<u>Static/dynamic experiment</u> Dynamic
	<u>Temperature range in the test section (ΔT)</u> Typical temperature range: 100 - 880 °C (sodium liquid phase)
	<u>Operating pressure and design pressure</u> TS #1: design pressure 490 kPa (gauge) TS #2: design pressure 290 kPa (gauge)
	<u>Flow range (mass, velocity, etc.)</u> TS #1: typical ventilation rate 30 m ³ /min TS #2: typical ventilation rate 3 m ³ /min
	Coolant chemistry measurement and control (active or not, measured parameters)
Instrumentation	Thermocouples, pressure transducer, oxygen sensor, flow meter.

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

Several tens of experiments have been conducted since 1980's in the SAPFIRE facility to investigate fundamental behaviours, thermal consequences, and mitigating measures of sodium leak and fire accident. The experimental study covers various sodium combustion patterns in pool, columnar, and spray forms both in an air atmosphere and in low oxygen concentration condition. Sodium aerosols behaviours were also investigated.

The obtained experimental results are utilized for development and validation of sodium fire numerical analysis code system as well as for investigating the important phenomena in sodium fire and for demonstrating the effectiveness of sodium fire mitigation system adopted in the prototype FBR plant Monju.

PLANNED EXPERIMENTS (including time schedule)

No specific experimental program is planned in 2019 and 2020.

TRAINING ACTIVITIES

No specific training activities using the SAPFIRE facility.

REFERENCES (*specification of availability and language*)

- Y. Himeno, S. Miyahara, T. Morii, and K. Sasaki, “Engineering Scale Test on Sodium Leak and Fire Accident and Its Consequences in Auxiliary Building of Fast Breeder Reactors,” Proceedings of Fourth International Conference on Liquid Metal Engineering and Technology, October 17-21, 1988, Avignon, France, 202. (En)
- O. Miyake, H. Tanabe, “Overview of PNC Studies of Source Term and Sodium Fires for FBRs,” Proceedings of IAEA/IWGFR Technical Committee Meeting on Evaluation of Radioactive Materials Release and Sodium Fires in Fast Reactors, O-arai, Ibaraki, Japan, November 11-14, 1996, pp. 75-79. (En)
- K. Kawata, T. Teraoku, S. Ohno, S. Miyahara, O. Miyake, H. Tanabe, “Investigation for the Sodium Leak in Monju – Sodium Fire Test-I -,” JNC TN9400 2000-089, 2000. (En)
- N. Uchiyama, T. Takai, M. Nishimura, S. Miyahara, O. Miyake, H. Tanabe, “Investigation for the Sodium Leak in Monju – Sodium Fire Test-II -,” JNC TN9400 2000-090, 2000. (En)
- S. Miyahara, S. Ohno, H. Ishikawa, N. Doda, “Sodium Leak and Fire Control in Fast Breeder Reactors,” Journal of the Combustion Society of Japan, Vol. 45, No. 133, 2003, pp. 141-151 (Japanese)
- M. Nishimura, S. Futagami, S. Ohno, S. Miyahara, “Characteristics of Sodium Pool Burning Behavior in Small Leakage,” Transactions of the Atomic Energy Society of Japan, Vol. 6, No. 2, pp.149-160, 2007. (Japanese)
- S. Ohno, H. Ohshima, Y. Tajima, H. Ohki, “Development of PIRT and Assessment Matrix for Verification and Validation of Sodium Fire Analysis Codes,” Journal of Power and Energy Systems, Vol. 6, No. 2, 2012, pp. 241-254 (En)