Profile LFR-5

HLM

BELGIUM

GENERAL INFORMATION
NAME OF THE FACILITY: Heavy Metals Lab
ACRONYM: HLM
COOLANT(S) OF THE FACILITY: LBE
LOCATION (address): SCK•CEN, Boeretang 200, 2400, Mol, Belgium
OPERATOR: SCK•CEN
CONTACT PERSON (name, address, institute, function, telephone, email):
Dr. Alexander Aerts
LBE-CCP
Nuclear Systems Research
Tel. +32 (0) 1433 8018
Email alexander.aerts@sckcen.be

Cc to: Dr. Jun Lim
LBE-CCP
Nuclear Systems Research
Tel. +32 (0) 1433 8015
Email Jun.Lim@sckcen.be

STATUS OF THE FACILITY
in operation
Start of operation (date):

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 heavy metals lab (HML) finished construction end of 2012 and is equipped to perform chemistry experiments with heavy metals in a controlled and safe way. The HML houses an inert gas glove box which contains a so-called transpiration setup, used for the study of evaporation of impurities from LBE under various conditions of temperature and gas atmosphere composition. Typical impurities under investigation with this setup include fission products such as iodine and cesium which are important for the safety of LBE cooled accelerator driven nuclear systems. Recently a triple filter quadrupole mass spectrometer was connected to the evaporation setup, to study the gas-phase chemistry of evaporated molecules. Since the beginning of 2013, the HML also houses a home-made dedicated setup to study evaporation of mercury from LBE. Because mercury is a safety-critical contaminant in LBE cooled accelerator driven nuclear systems, its evaporation must be well-understood. Besides setups for evaporation studies, several small LBE setups are being used in the HML including several LBE autoclaves for oxygen sensor and oxygen-pump testing, a setup for electronic impedance spectroscopy studies of sensor membranes and autoclaves with oxygen control for corrosion studies under stagnant LBE conditions.

Acceptance of radioactive material
No

Scheme/diagram

3D drawing/photo

Parameters table
Coolant inventory | several autoclaves, 6 kg LBE each  
---|---  
Power | 1 kW autoclave heaters, 1 kW tubular furnace  
Test sections  
TS #1 |  
| **Characteristic dimensions**  
| LBE autoclaves ø100 mm  
| **Static/dynamic experiment**  
| static & dynamic (evaporation)  
| **Temperature range in the test section (ΔT)**  
| up to 500 °C (conditioning and corrosion experiments), up to 1000 °C (evaporation setup)  
| **Operating pressure and design pressure**  
|  
| **Flow range (mass, velocity, etc.)**  
|  
| Coolant chemistry measurement and control (active or not, measured parameters) | electrochemical oxygen pump, gas-liquid exchange oxygen control  
| Instrumentation | oxygen sensors, mercury detector (fluorescence), mass spectrometer  

**COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS**

- Evaporation  
  - Mercury: measurement of Henry constants of mercury impurity in solid and liquid LBE, mercury diffusion coefficients in solid LBE  
  - Iodine: measurement of Henry constants of iodine impurity in liquid LBE  
  - Cadmium: measurement of Henry constants of cadmium impurity in liquid LBE  
- Oxygen measurement and control  
  - Calibration and testing of low-temperature (200 °C minimum) oxygen sensors for LBE  
  - Testing of electrochemical oxygen pumps  

**PLANNED EXPERIMENTS (including time schedule)**
The following activities are planned in 2015-2016:

- Evaporation of fission products from LBE.  
- Measurement and control of dissolved oxygen in LBE.  
- Corrosion experiments in autoclaves with stagnant, oxygen-controlled LBE.  

**TRAINING ACTIVITIES**
Training activities are possible, availability allowing and after prior agreement under supervision of SCK-CEN Qualified staff.
REFERENCES (specification of availability and language)


