

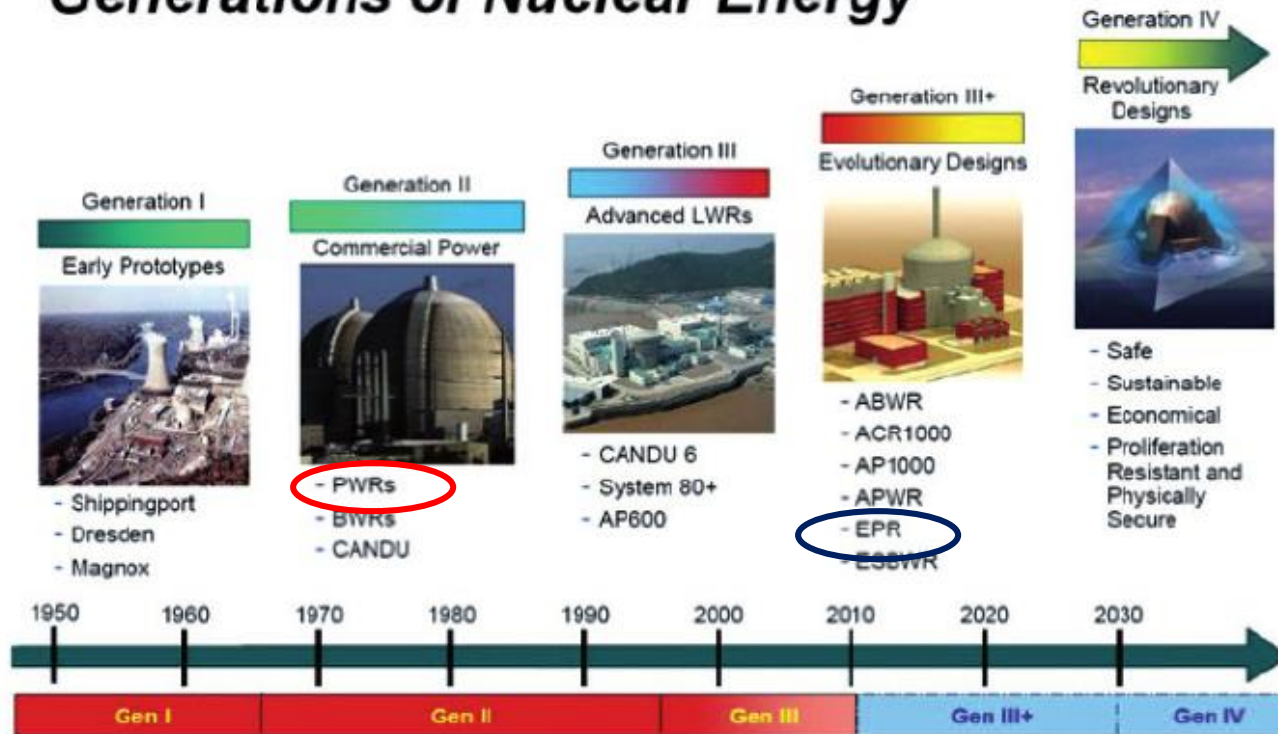
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Summer talk

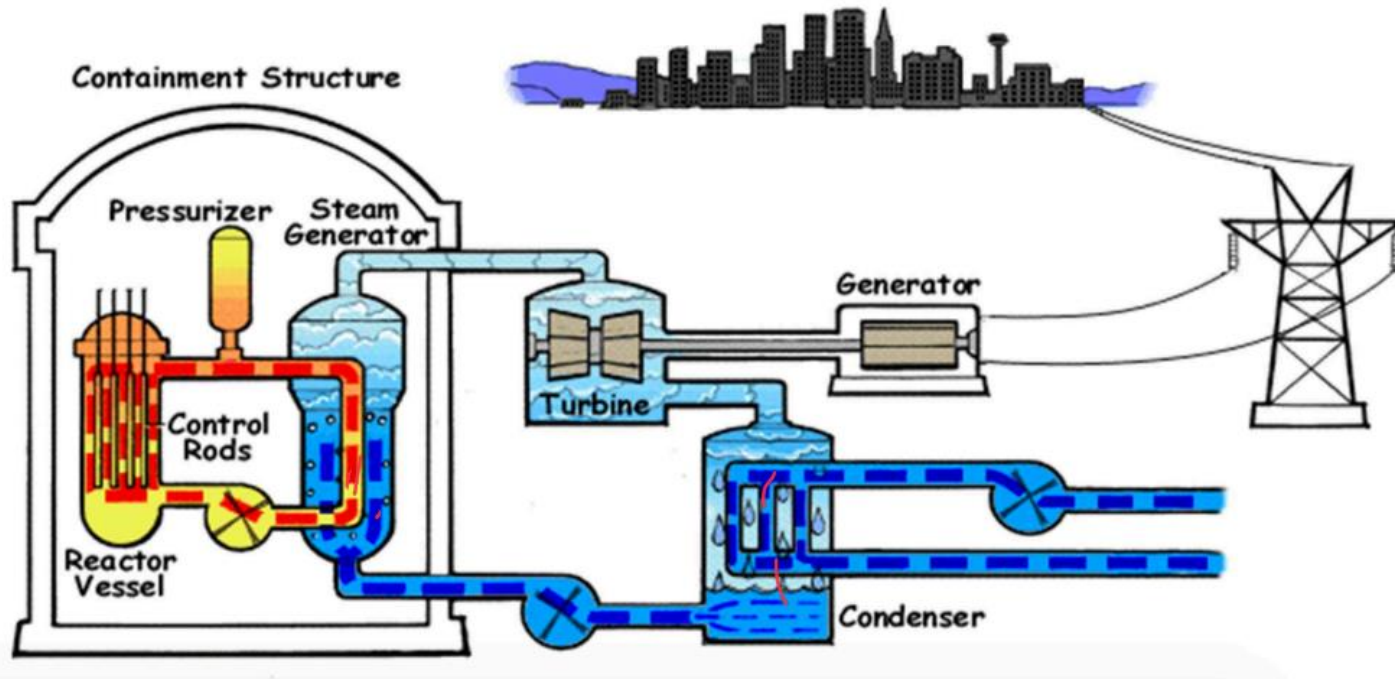
**Polonium evaporation
from LBE at low temperature**

Jocelyn Soppo
LRC, 07/08/2024

Generations of Nuclear Energy



- Switzerland: Generation II PWR (Pressured Water Reactor's)
- Generation III+ in Europe: EPR (European Pressured Reactor)
- Generation IV:
 - GFR
 - MSR
 - SFR
 - SCWR
 - VHTR
 - LFR

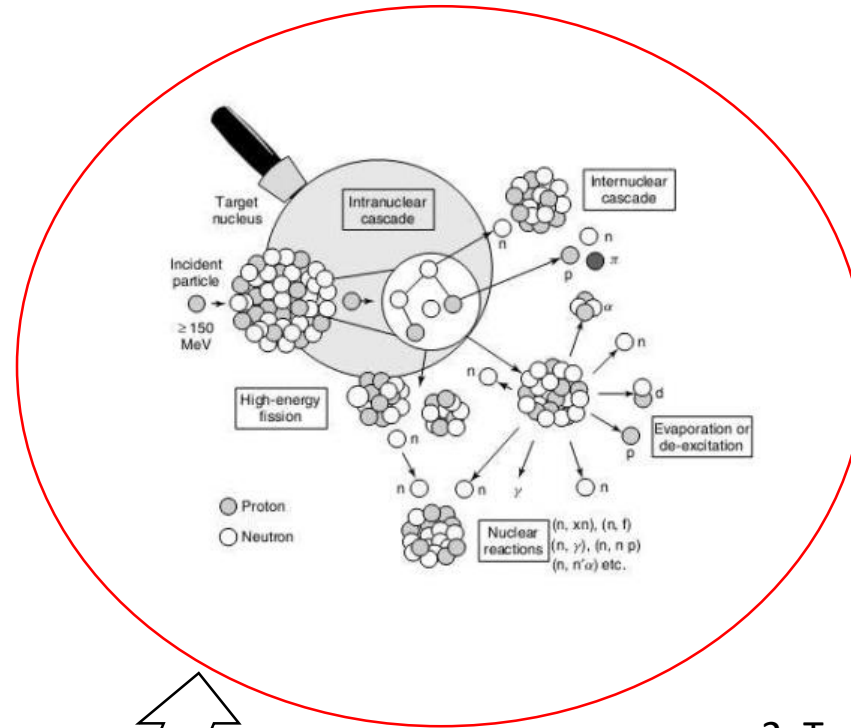
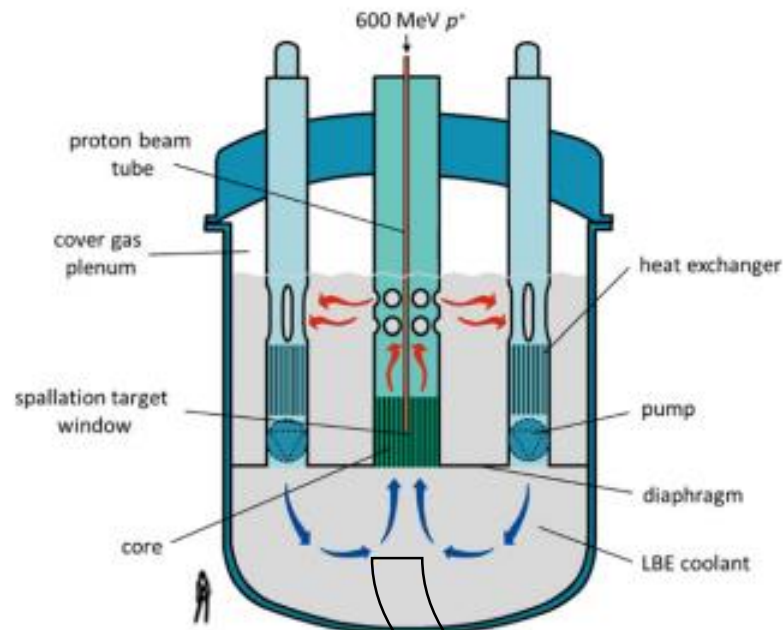


SO WHY THE GEN IV?

- Fission reaction releases energy
- Pressured water act as coolant
- Thermal transfer between the primary and secondary water circuit
- Water in the secondary circuit evaporates and spins the turbine
- Induction phenomenon creates electricity

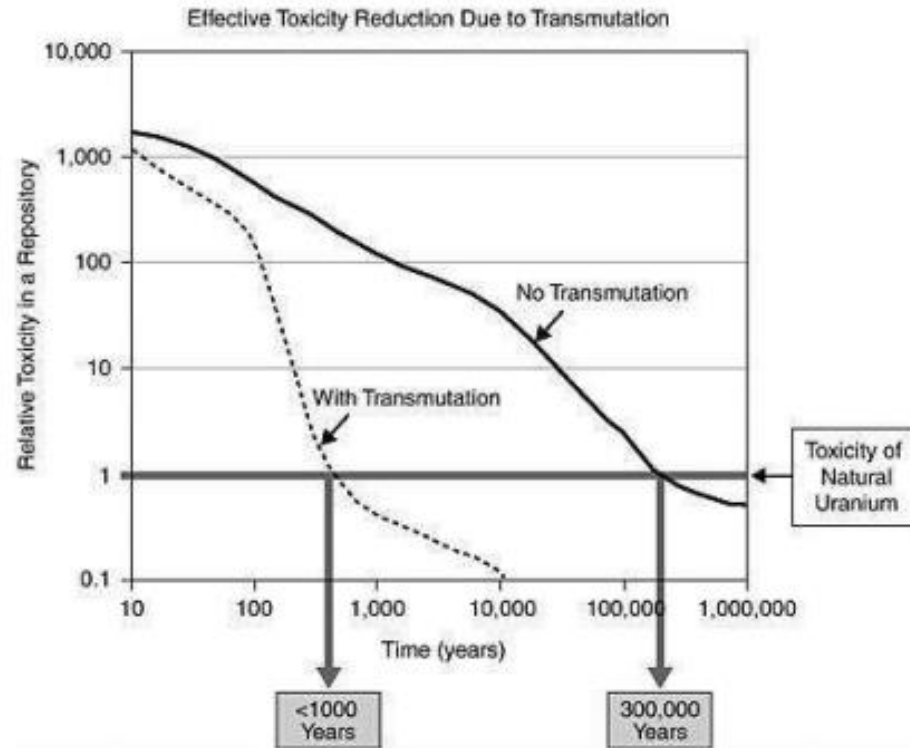
MYRRHA project

Multi-purpose Hybrid Research Reactor for High-tech Application (MYRRHA) standing out as first of a kind demonstrator for **transmutation**



1. Neutron produced feed the fission reaction

2. Transmutation



Much shorter half life radionuclides

Main benefits of MYRRHA



1. Safety issues in case of nuclear accident

By stopping the proton beam, we stop the fission reaction

Extremely hard to evaporate lead and bismuth

2. Long lived radionuclides handling

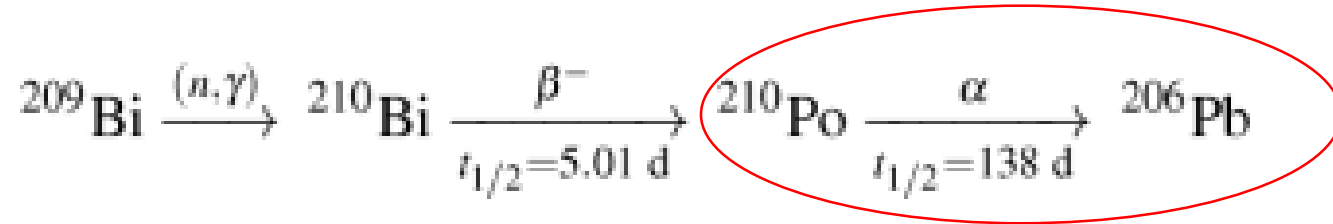
Transmutation makes it possible to have a better visibility on active waste behavior

3. Nuclear fuel used

Possibility to use fast neutrons → ^{238}U instead of ^{235}U (only 0.7% of the total Uranium on Earth is ^{235}U isotope)

WHY AM I EVEN EMPLOYED HERE THEN ?

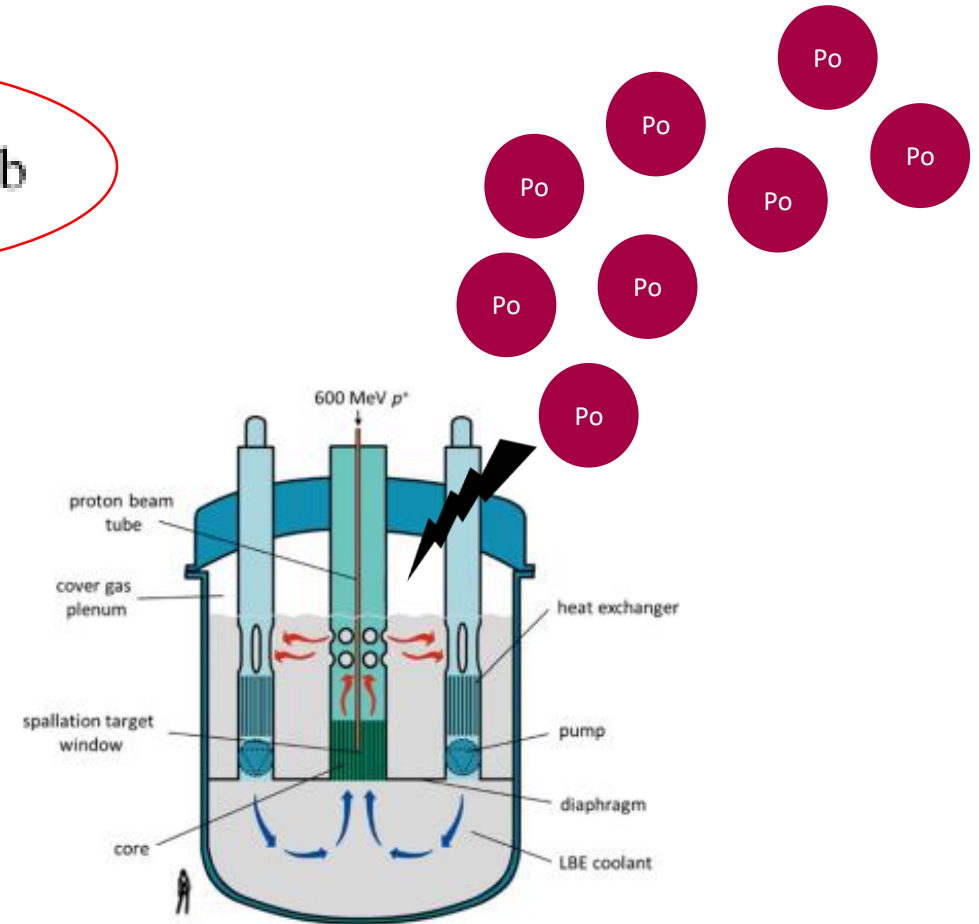
THE main disadvantage of MYRRHA



Neutron capture of Bi

POLONIUM IS A VOLATILE COMPONENT

→ In case of nuclear accident:



Aim of the internship

Determine the influence of impurities in Lead-Bismuth Eutectic (LBE) samples

Pure LBE at high temperature



Pure LBE at low temperature



MEGAPIE LBE at high temperature

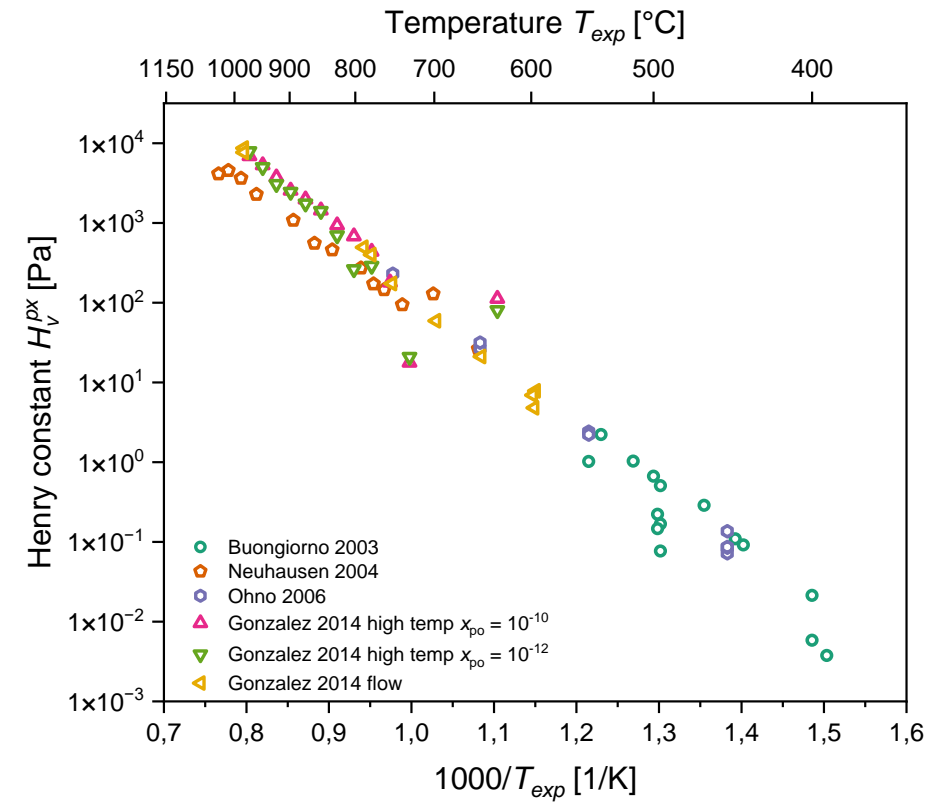
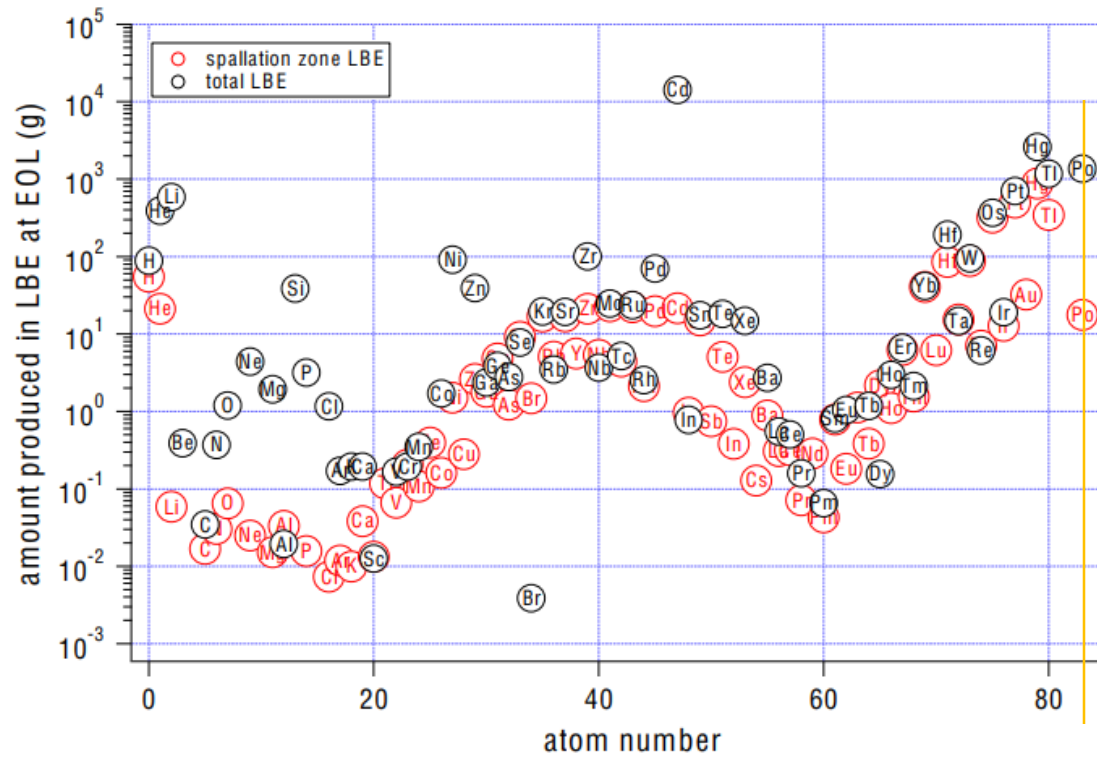


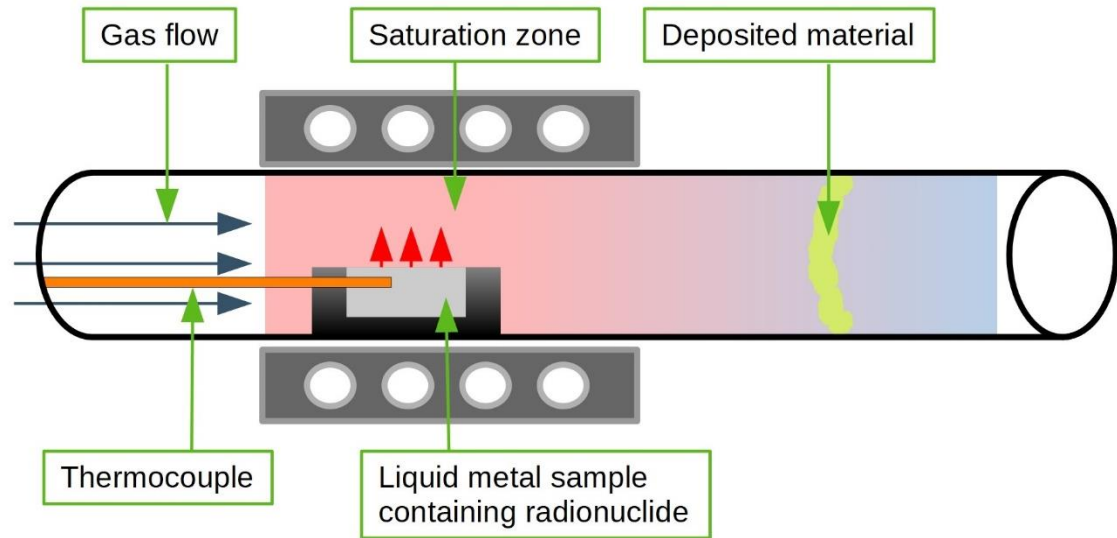
MEGAPIE LBE at low temperature



MEGAPIE: MEGAwatt Pilot Experiment ; high intensity proton beam used to irradiate the LBE

Aim of this internship





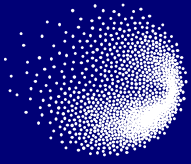
Between each transpiration

- Initial LBE activity
- Remaining LBE activity
- Evaporated activity and its distribution in washing fraction
- P_o vapor pressure → Henry constant

Transpiration time : 15mins, 30 mins, 1h, 5h and 20h

Temperature tested : 600 °C, 500 °C, 400 °C, 300 °C

$$p_{Po} = \frac{\Delta n_{Po(lbe)}}{\Delta t} \frac{RT}{\dot{V}}$$



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Thank you for your attention

Question ?