

# Third ISOE European Workshop on « Occupational Exposure Management in Nuclear Power Plants »



## Impact of Main Radiological Pollutants on Contamination Risks (ALARA)

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# SUMMARY

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## 1 – NORMAL CONTAMINATION (REMINDE)

## 2 – EXTRA POLLUTIONS – OVER CONTAMINATION

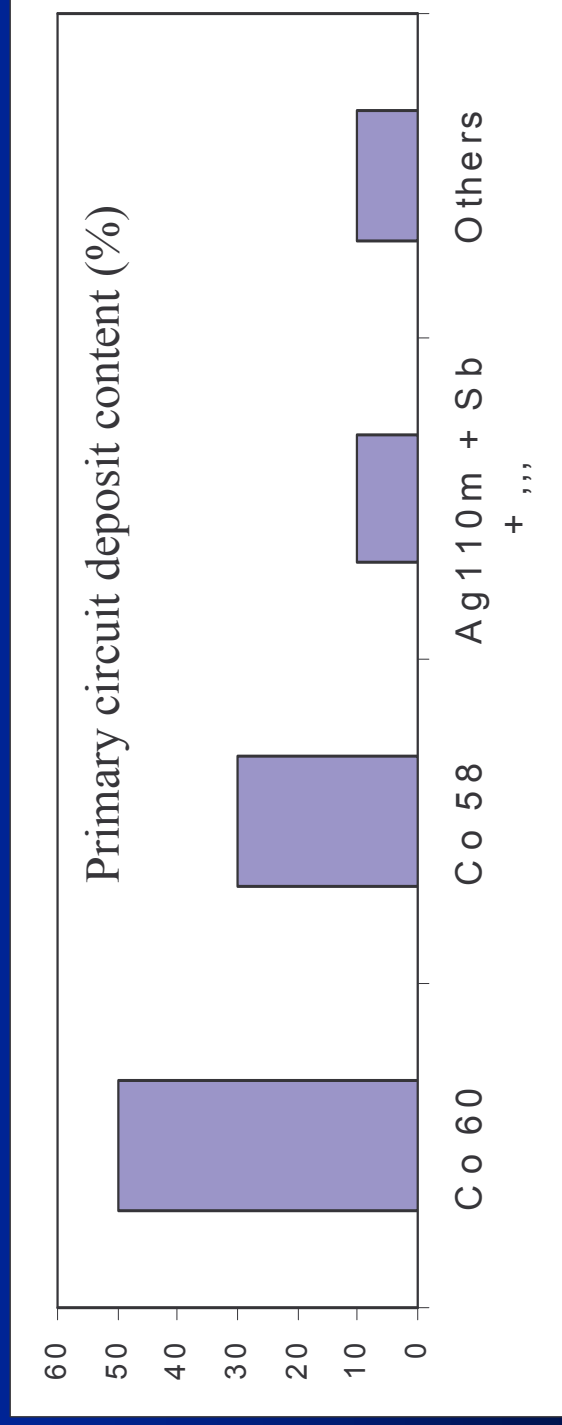
- Origin – Behaviour
- Indicator - Impact on doses
- Preventive strategy

## 3 - CONCLUSIONS AND FUTURE PROSPECTS

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# NORMAL CONTAMINATION (REMIND)

90% of DOSES are due to CORROSION PRODUCTS



80% of DOSES are integrated during OUTAGE

## **EXTRA POLLUTIONS**

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**Meanwhile, operators have to cope with**

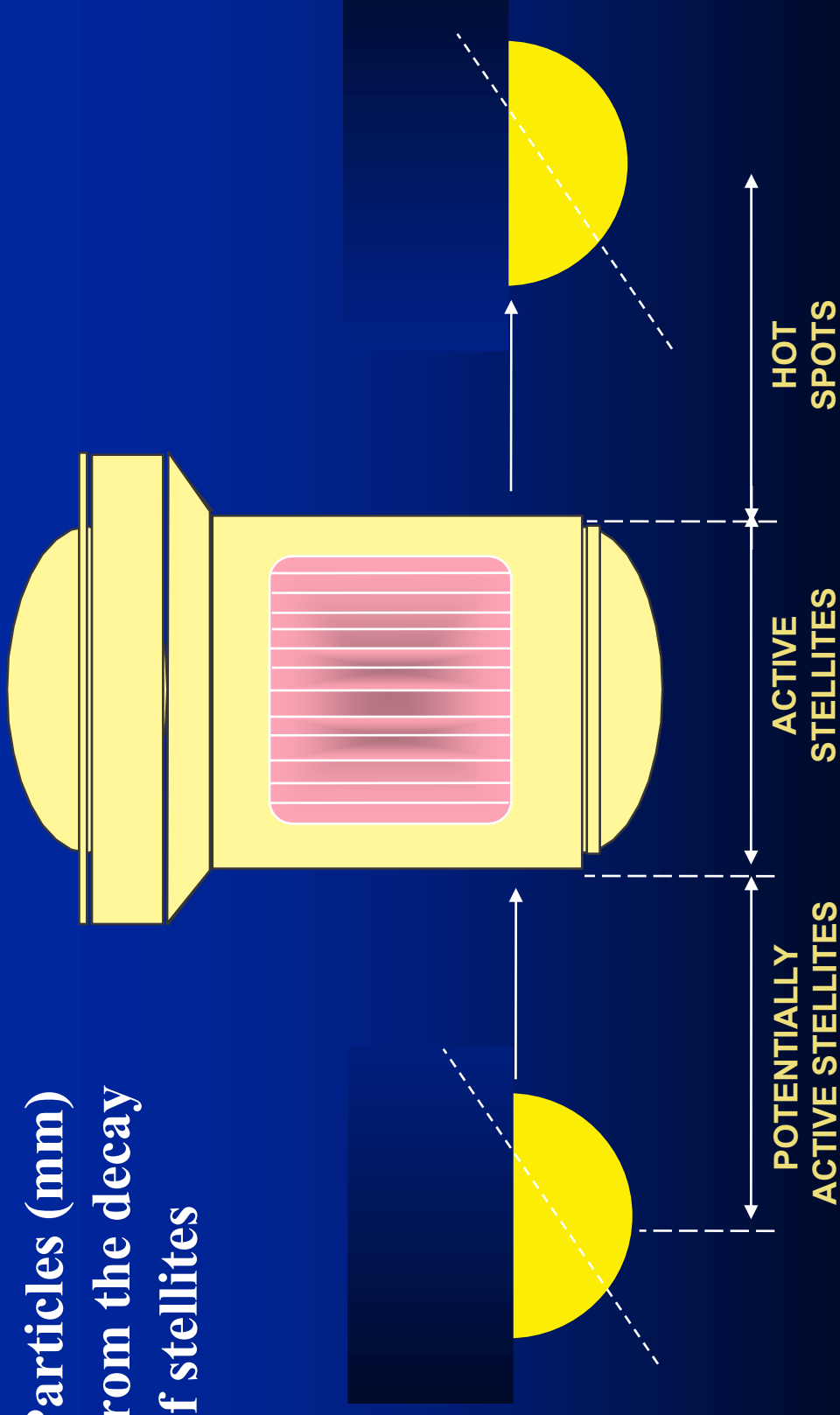
## **EXTRA POLLUTIONS**



**HOT SPOTS – SILVER – ANTIMONY**  
**responsible for 10 - 30% of doses**

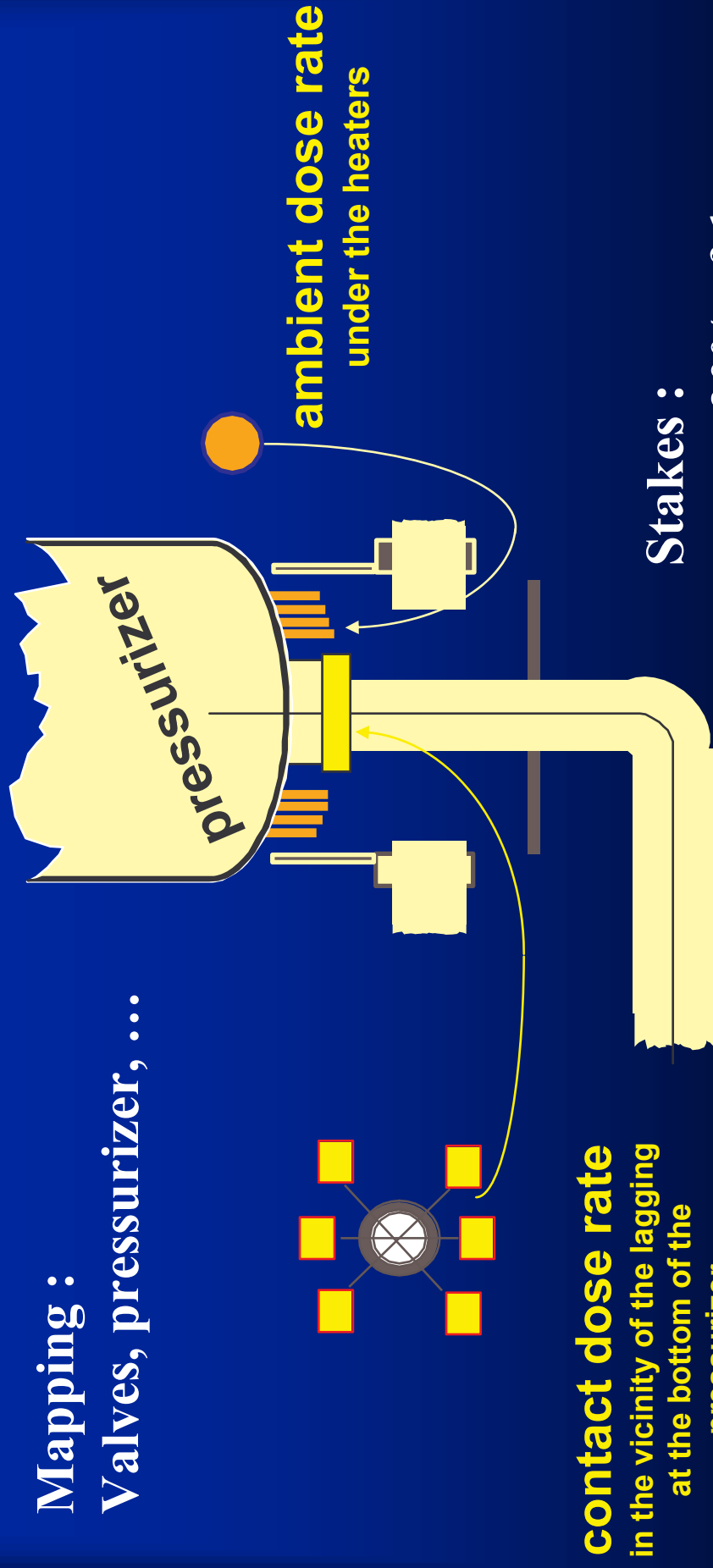
# HOT SPOTS - ORIGIN

Particles (mm)  
from the decay  
of stellites



# HOT SPOTS - INDICATORS - STAKES

Mapping :  
Valves, pressurizer, ...

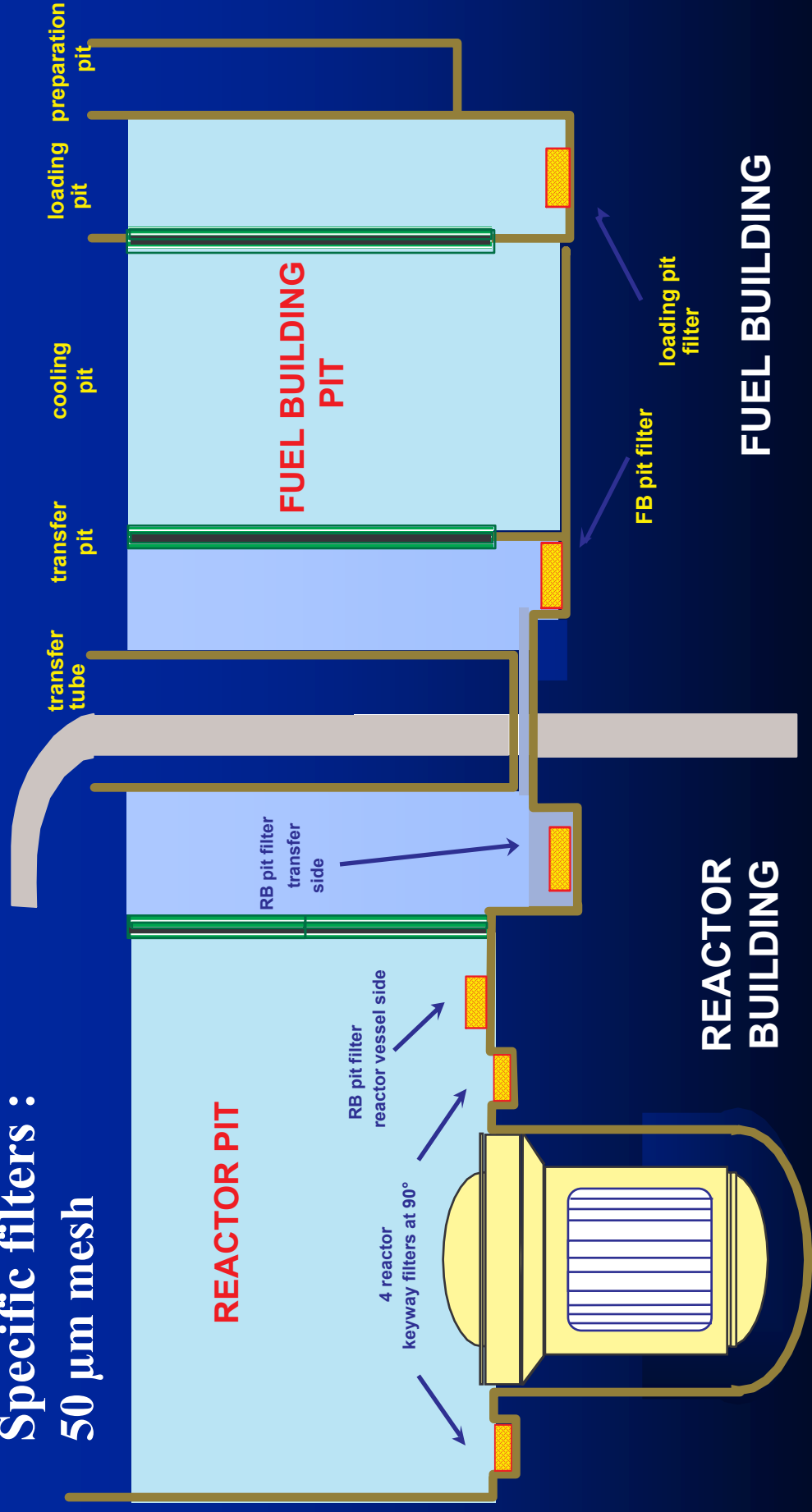


Stakes :

- up to 30% of doses
- sensitive population

# HOT SPOTS – PREVENTIVE STRATEGY

Specific filters :  
50  $\mu\text{m}$  mesh



# SILVER

- – **Origin**

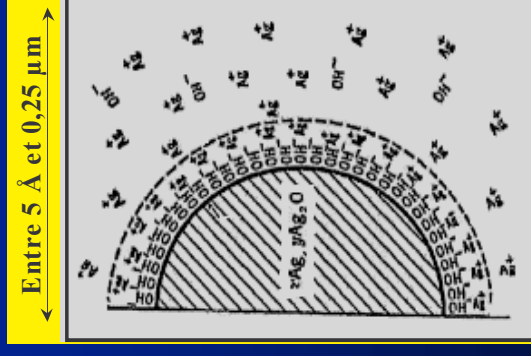
↳ Neutron-absorbing alloy Ag-In-Cd contained in control rods + Silver coated seals

- – **Behaviour**

↳ Likely under colloidal form

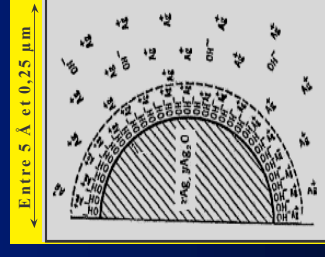
- – **Indicator**

↳ Oxygenation peak :  $^{110m}\text{Ag} > 3 \text{ GBq/T}$  (30 grammes Ag)



# SILVER

- – **Impact on doses**
  - ➔ 5 to 10% - Cold parts of CVCS, ... ( 90% of dose rates)
- – **Preventive strategy**
  - ➔ Standard control rod replacement by « Coating » control rod
  - ➔ Shutdown conditions
    - Acidic chemistry (to destroy colloids)
    - + Specific filters and resins (to improve purification)



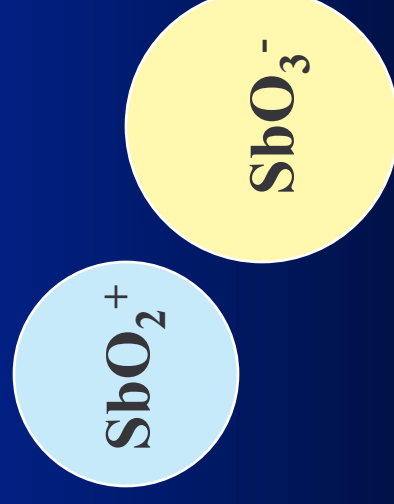
# ANTIMONY

## ○ -- Origin

↳ Pumps bearing wear in Boron Recycle System (made with graphite impregnated with about 10% of antimony)

## ○ -- Behaviour

↳ Likely under ionic forms



## ○ -- Indicator

↳ Oxygenation peak :  $^{124}\text{Sb} > 60 \text{ GBq/T}$  (5 gramms Sb)

# ANTIMONY

- -- Impact on dosimetry

↳ 5 % - RCS Homogenously

- -- Preventive Strategy

Pumps bearing replacement (\*)

Cycles	13	14*	15
<sup>124</sup> Sb (GBqt)	100	60	20

↳ Specific shutdown chemistry  
Acidic (to improve Sb removal)



# CONCLUSIONS

Extra pollutions : hot spots, silver and antimony have been responsible for between 10 and 30 % of dosimetry

**Means of prevention are available :**

1 - Replacing Critical Materials when it is possible.

2 - Other Specific means :

- Filters allowing removal of hot spots
- Chemistry and purification conditions allowing removal of silver and antimony

## **FUTUR PROPECTS**

**Our priority (ALARA) is to minimise the probability of pollution phenomenon occurring (prevention).**

**In order to improve diagnostic, a specific gamma spectrometer able to characterize the nature of radioactive deposits is being developed.**