

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

1 – NORMAL CONTAMINATION (REMIND)

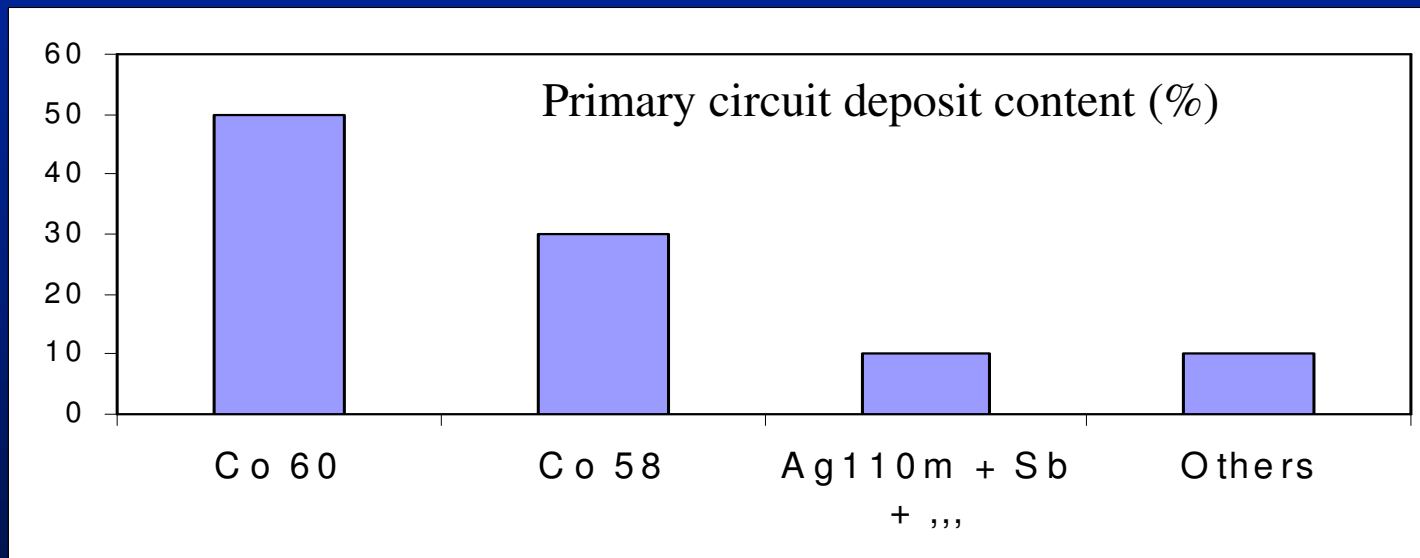
2 – EXTRA POLLUTIONS – OVER CONTAMINATION

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

3 - CONCLUSIONS AND FUTURE PROSPECTS

NORMAL CONTAMINATION (REMIND)

90% of DOSES are due to CORROSION PRODUCTS



80% of DOSES are integrated during OUTAGE

EXTRA POLLUTIONS

Meanwhile, operators have to cope with

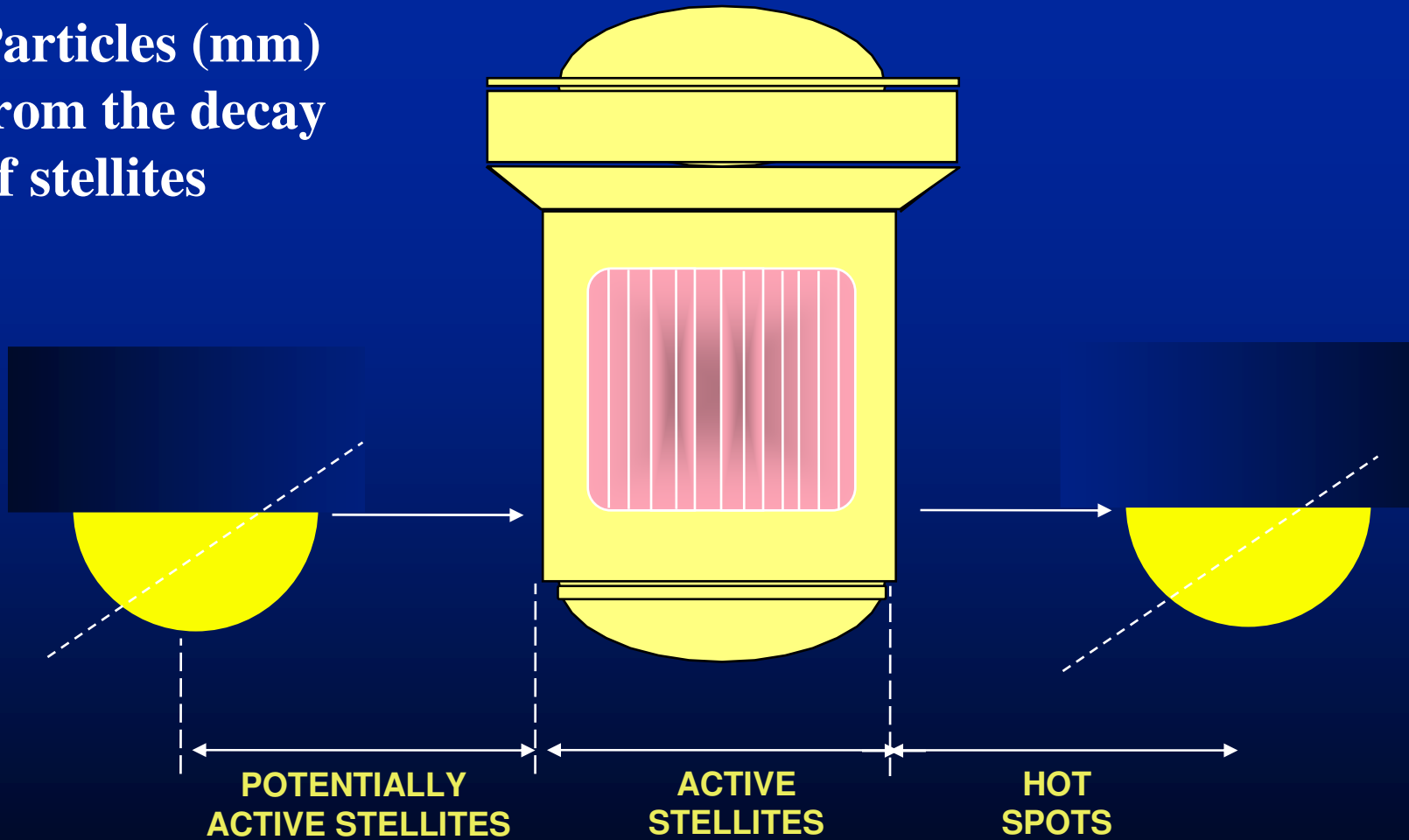
EXTRA POLLUTIONS



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

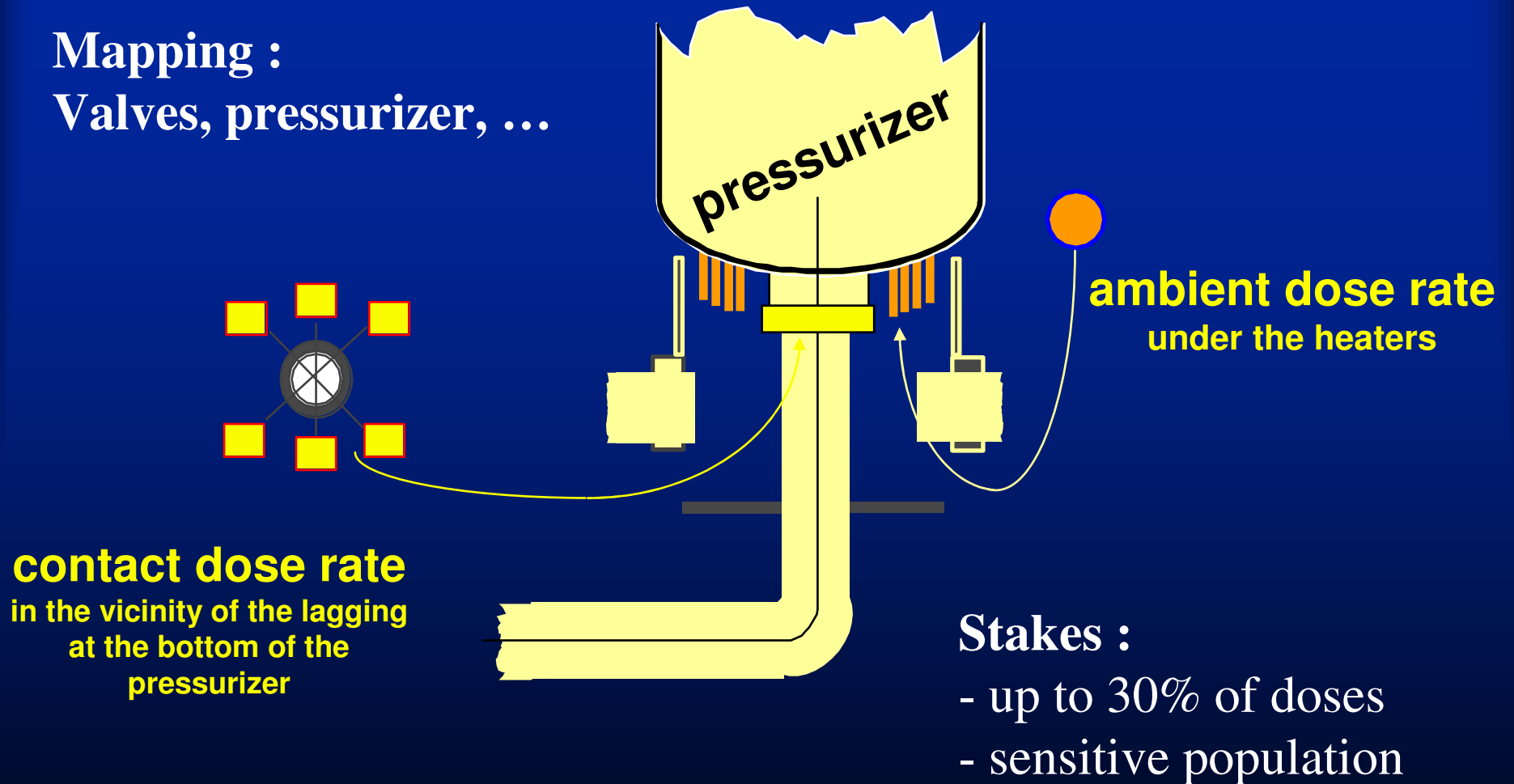
HOT SPOTS – ORIGIN

Particles (mm)
from the decay
of stellites



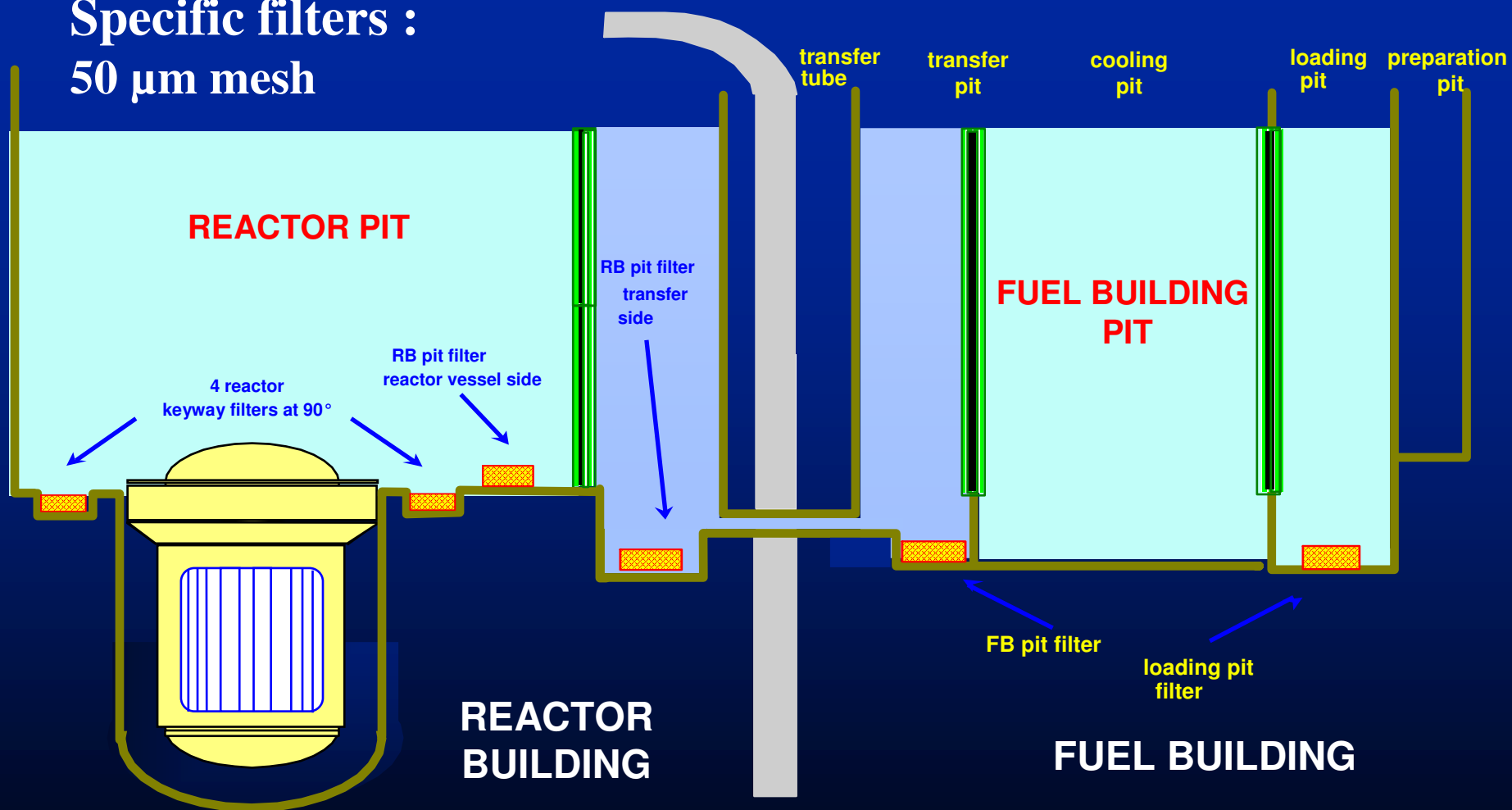
HOT SPOTS - INDICATORS - STAKES

Mapping :
Valves, pressurizer, ...



HOT SPOTS – PREVENTIVE STRATEGY

Specific filters :
50 μm mesh



SILVER

o – Origin

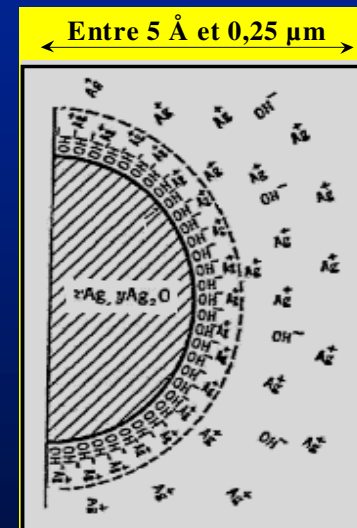
⇒ Neutron-absorbing alloy Ag-In-Cd contained in control rods + Silver coated seals

o – Behaviour

⇒ Likely under colloidal form

o – Indicator

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



SILVER

0 – Impact on doses

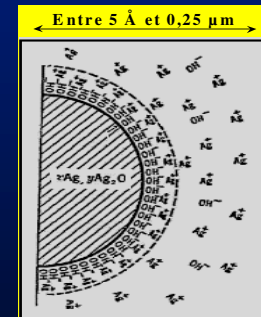
➡ **5 to 10% - Cold parts of CVCS, ... (90% of dose rates)**

- – Preventive strategy

Standard control rod replacement by « Coating » control rod

Shutdown conditions

Acidic chemistry (to destroy colloids)
+ **Specific filters and resins (to improve purification)**



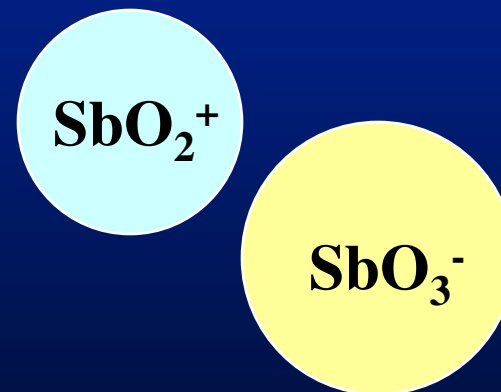
ANTIMONY

○ – 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 grammes Sb)

ANTIMONY

○ – Impact on dosimetry

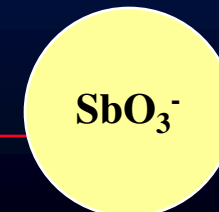
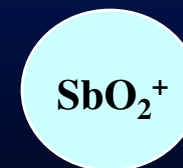
↳ 5 % - RCS Homogenously

○ – Preventive Strategy

Pumps bearing replacement (*)

Cycles	13	14*	15
^{124}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.