



Target shielding in a PET-production facility: Effect on the activation of the biological shield?

Peter Covens

VUB-UZ Brussel class IIA facility

- Located inside UZ Brussel, Laarbeeklaan 103, 1090 Jette



- CGR560 cyclotron: operation 1985-2020, currently under decommissioning
- IBA Cyclone® KIUBE: commissioned end 2017
- GMP-radiopharmacy

VUB-UZ Brussel class IIA facility

CGR 560 + irradiation room facilities

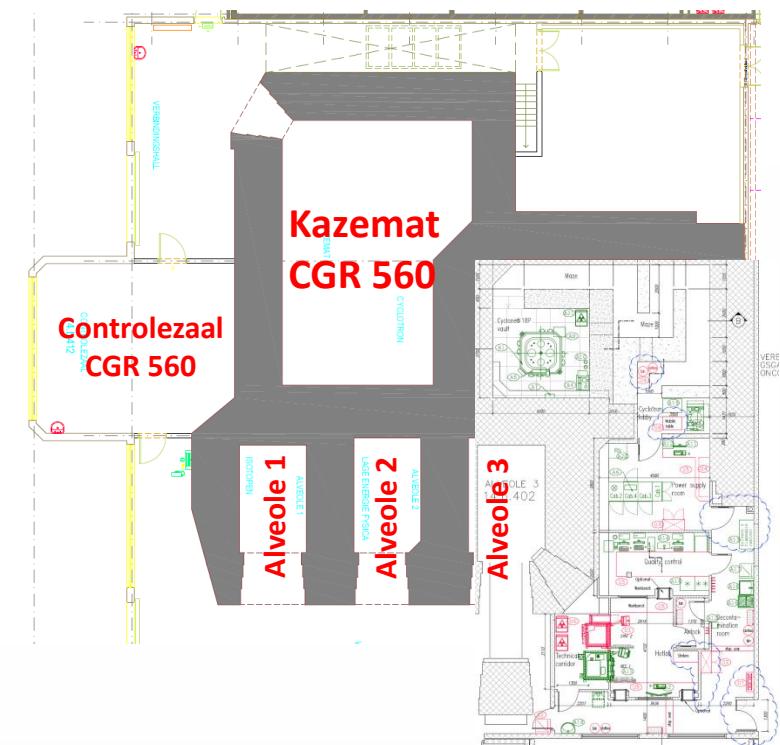
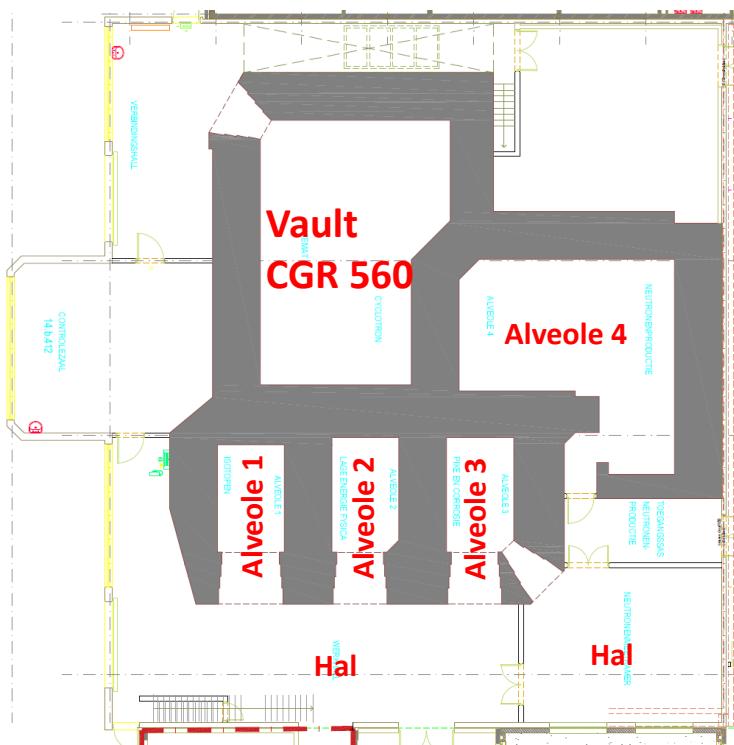


IBA Cyclone® KIUBE



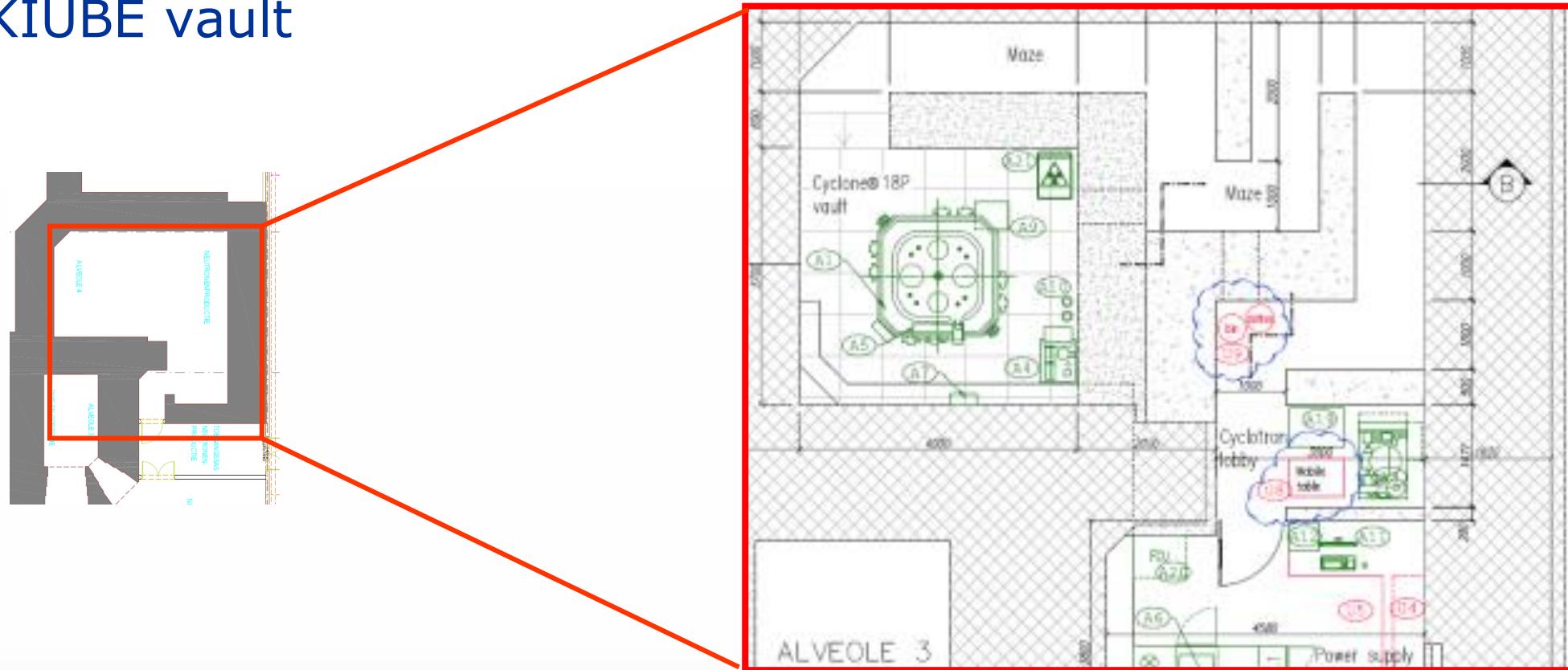
Some history

- 2016: transformation of CGR-irradiation room 4 into IBA Cyclone® KIUBE vault



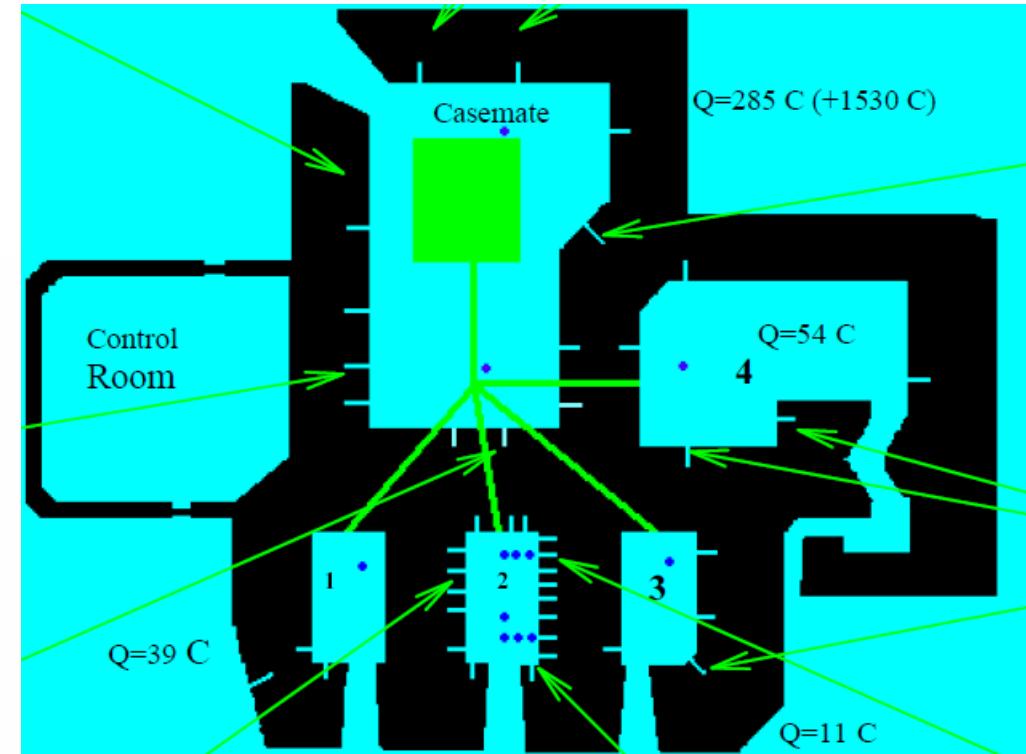
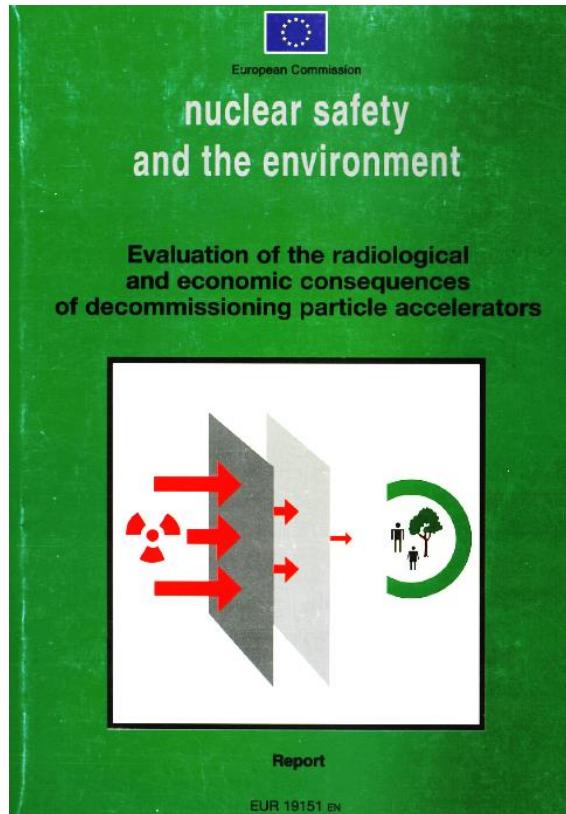
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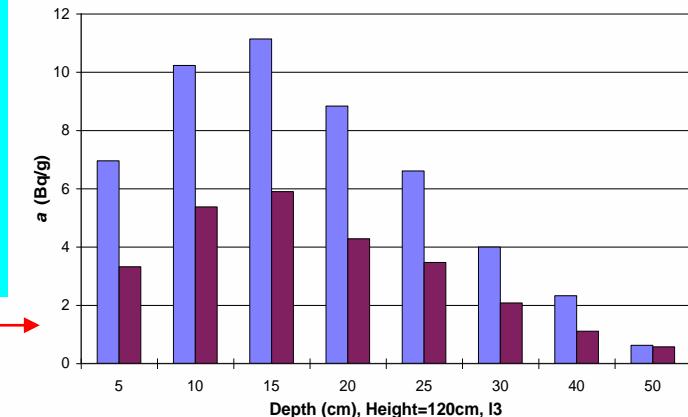
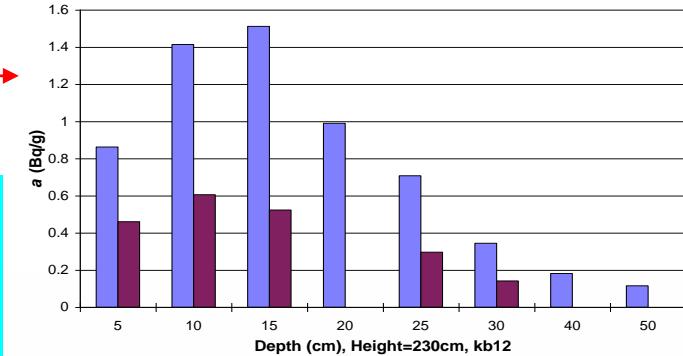
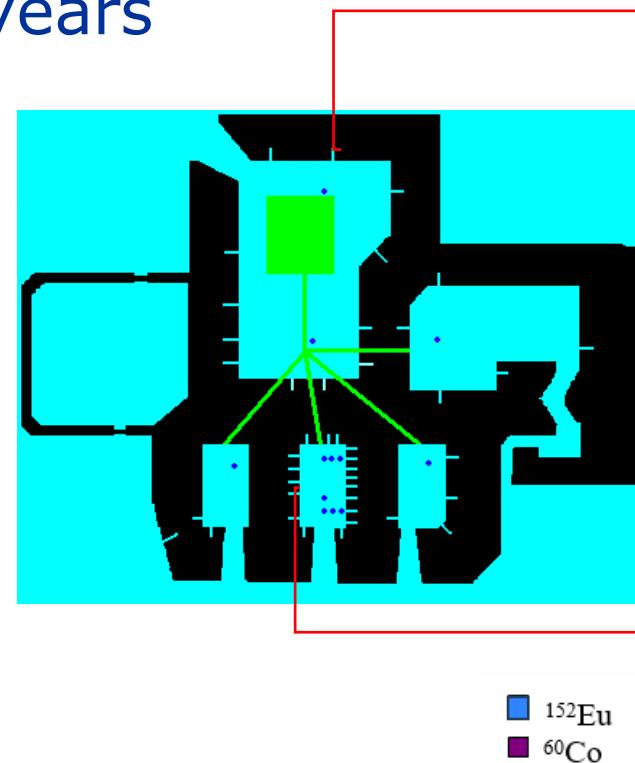
Some history

➤ What we already knew (1999)



Some history

- What we already knew (1999)
- Concrete activation after 10 years of operation
- CGR vault
 - ^{152}Eu : 1.5 Bq/g
 - ^{60}Co : 0.6 Bq/g
- Alveole 2
 - ^{152}Eu : 13 Bq/g
 - ^{60}Co : 6 Bq/g



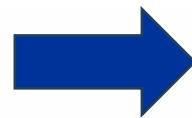
Some history

➤ Cause of activation

- (p,xn) reactions in CGR-cyclotron
- Alveole 2: production of ^{201}TI



- Relatively high cross-sections for thermal neutron activation



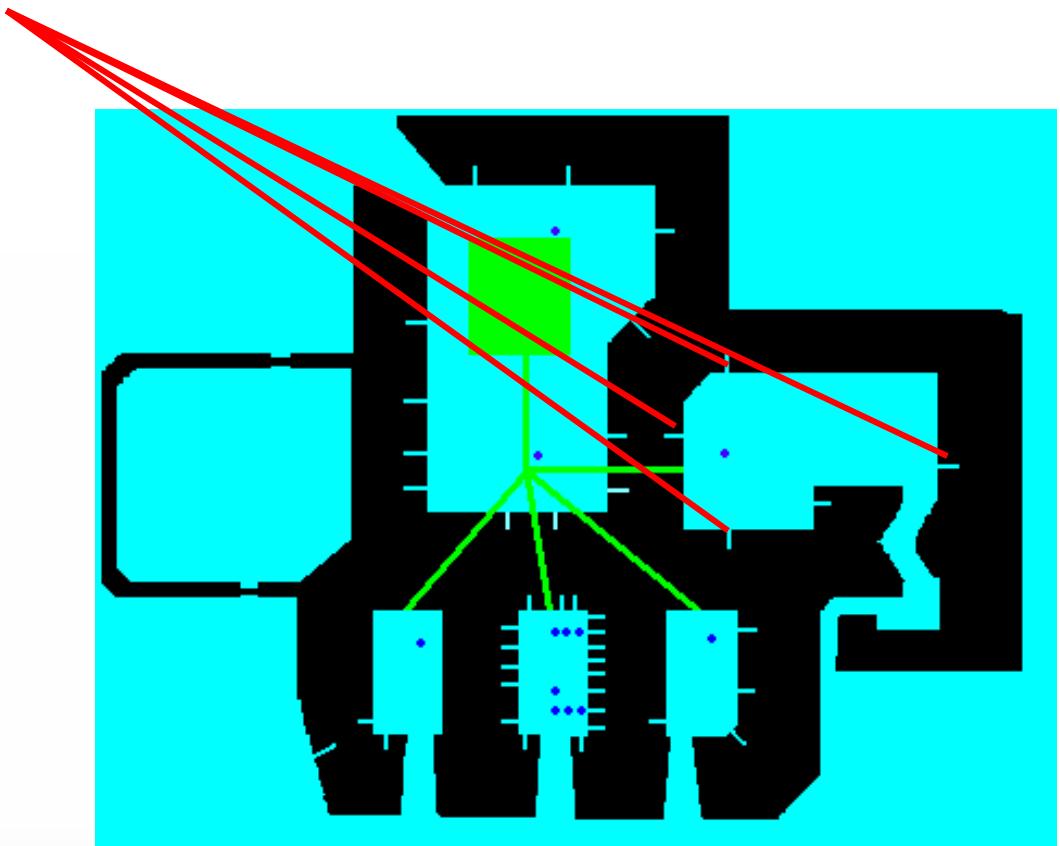
> 70m^3 activated concrete
> unconditional clearance levels
($^{152}\text{EU}/^{60}\text{Co}$)

Installation of the IBA Cyclone® KIUBE

- Alveole 4: activation levels < clearance levels

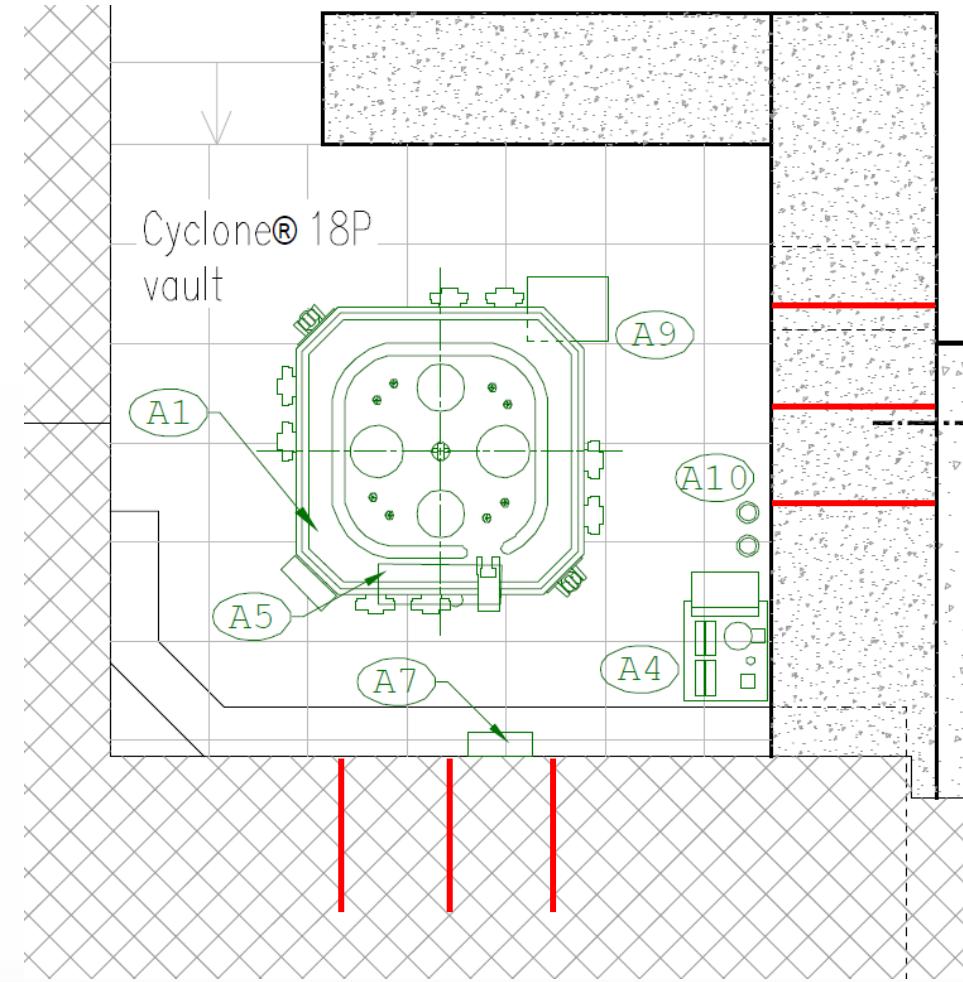


Drillings performed before the installation to monitor future activation



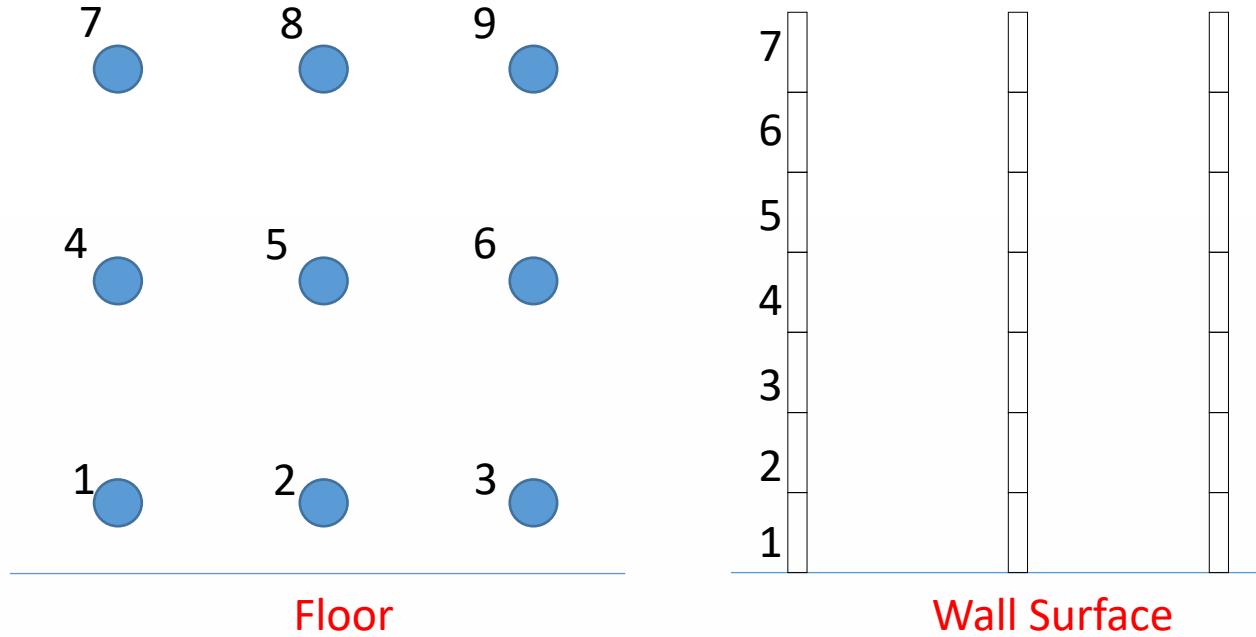
Drillings IBA Cyclone® KIUBE Vault

- Two walls
- Each wall 9 locations in a grid of 3x3
- Total depth: ± 100 cm
- 7 rods for each location ($\varnothing 4$ cm, length ± 150 cm)
- Easy to remove as rods can be put back in a (blind) PVC-tube



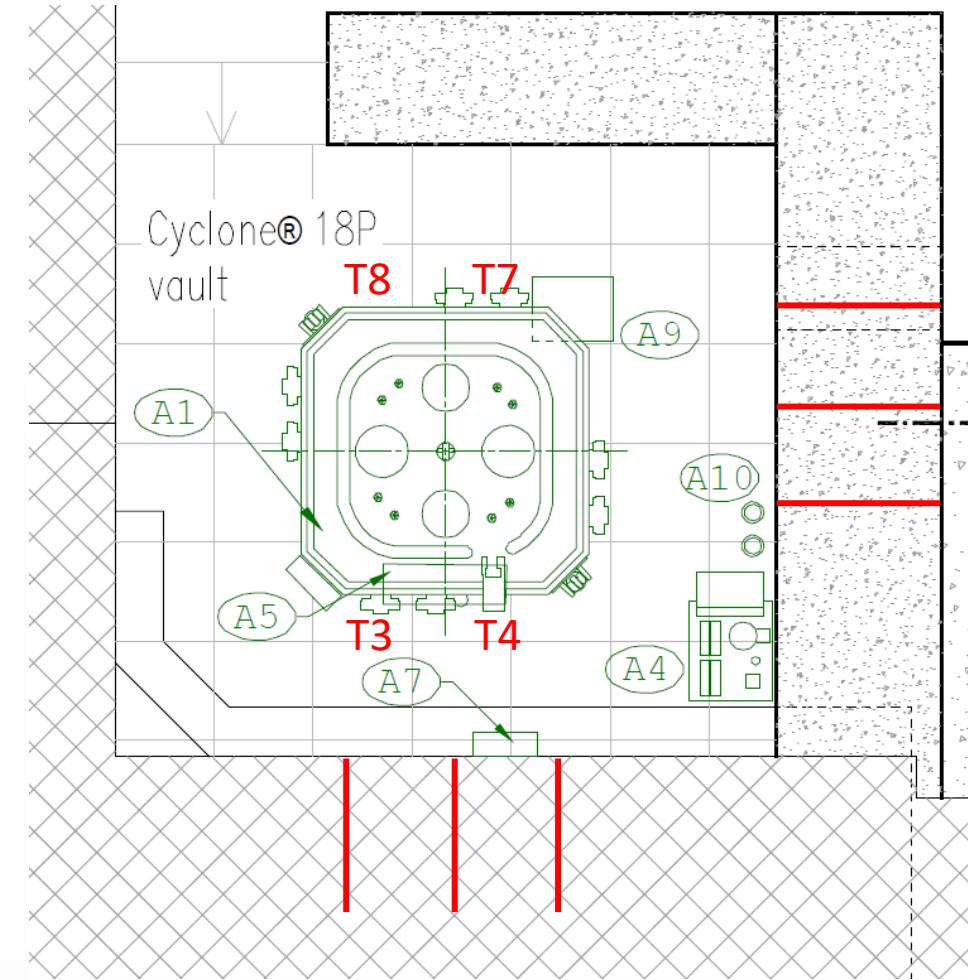
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Target location IBA Cyclone® KIUBE Vault

- 8 ports on Cyclone® KIUBE
- 4 out 8 ports used for Nirta® 18F conical liquid target
- 2 x 2XL on port 3 and 7
- 2 x 3XL on port 4 and 8

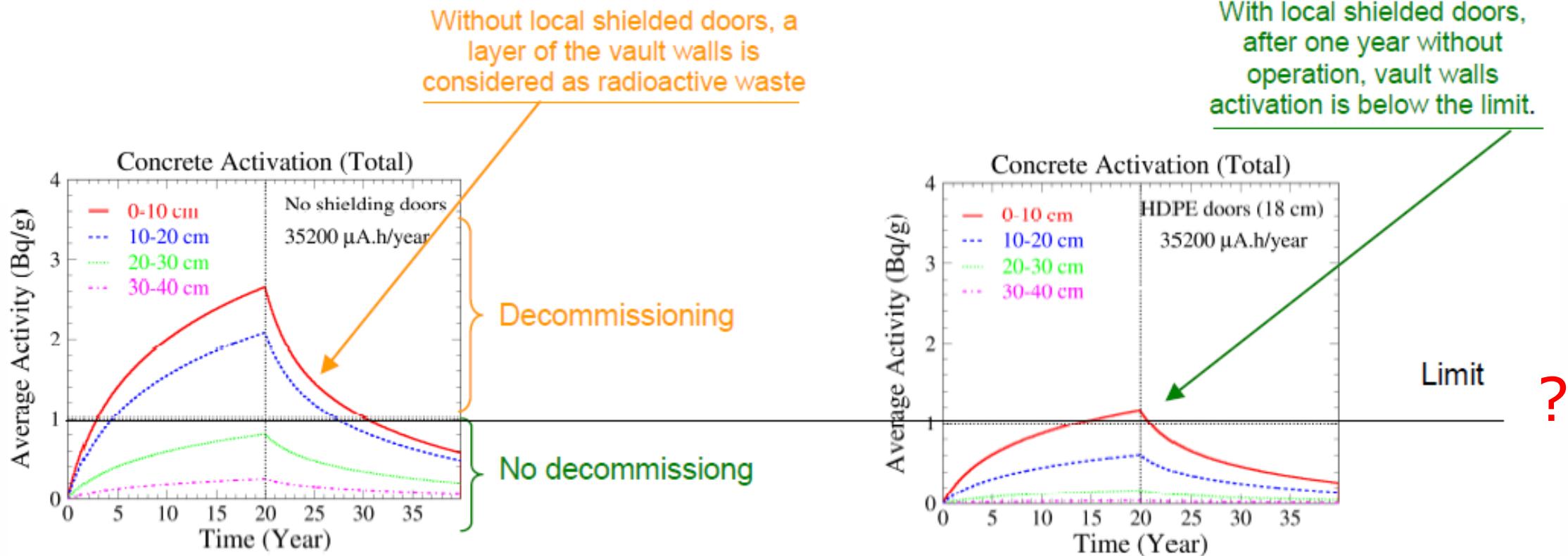


Installation Nirta® shielded doors

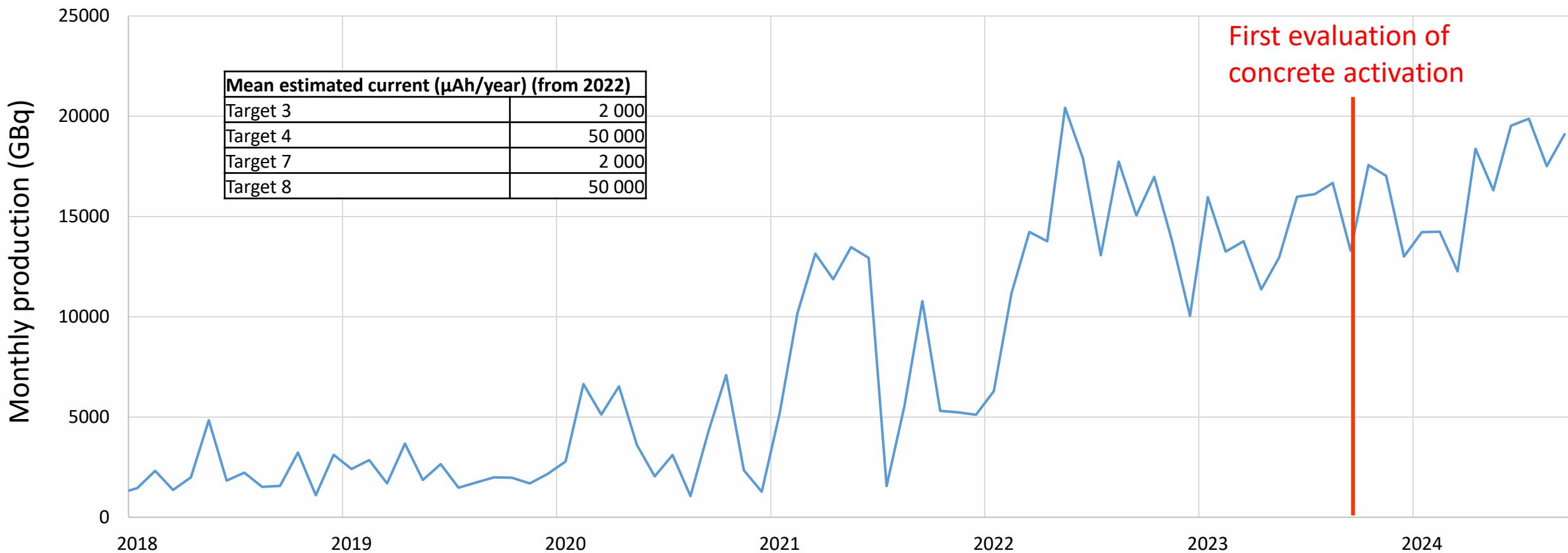
- On each target
- Neutron absorber (HDPE)
- Limit air activation
- Limit activation accelerator parts
- Limit activation of biological shield
- 30kEUR investment



Technical datasheet Nirta® shielded door

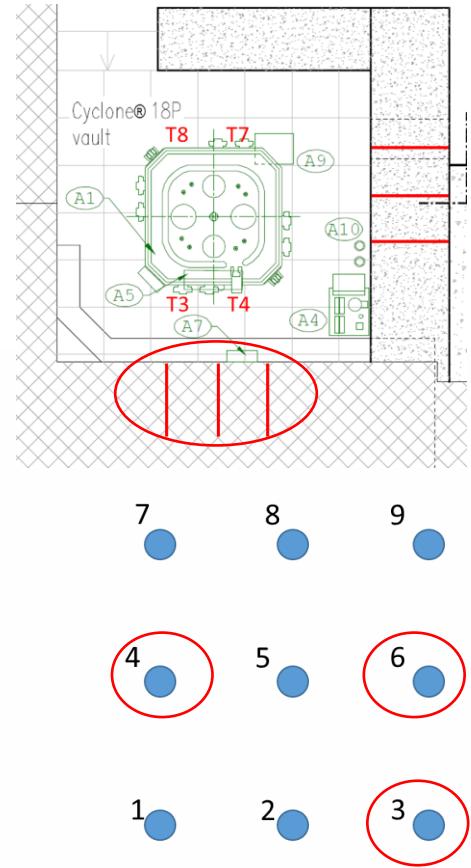
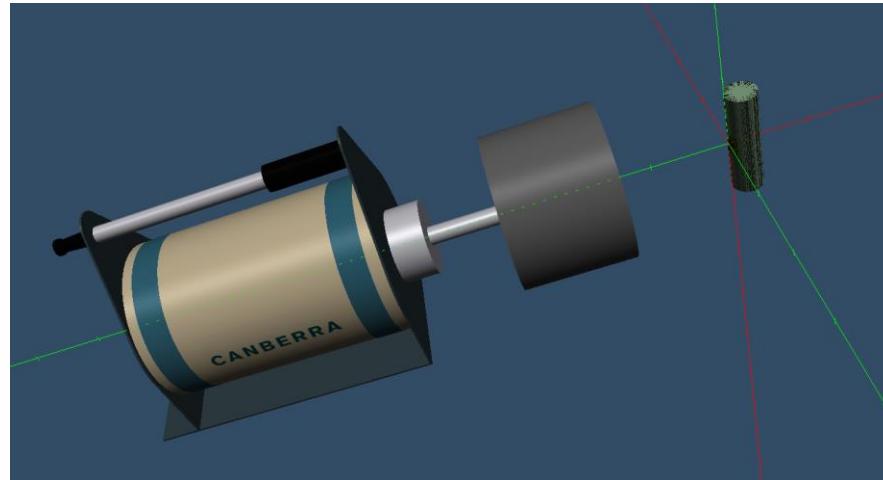


VUB-UZ workload Cyclone® KIUBE Vault

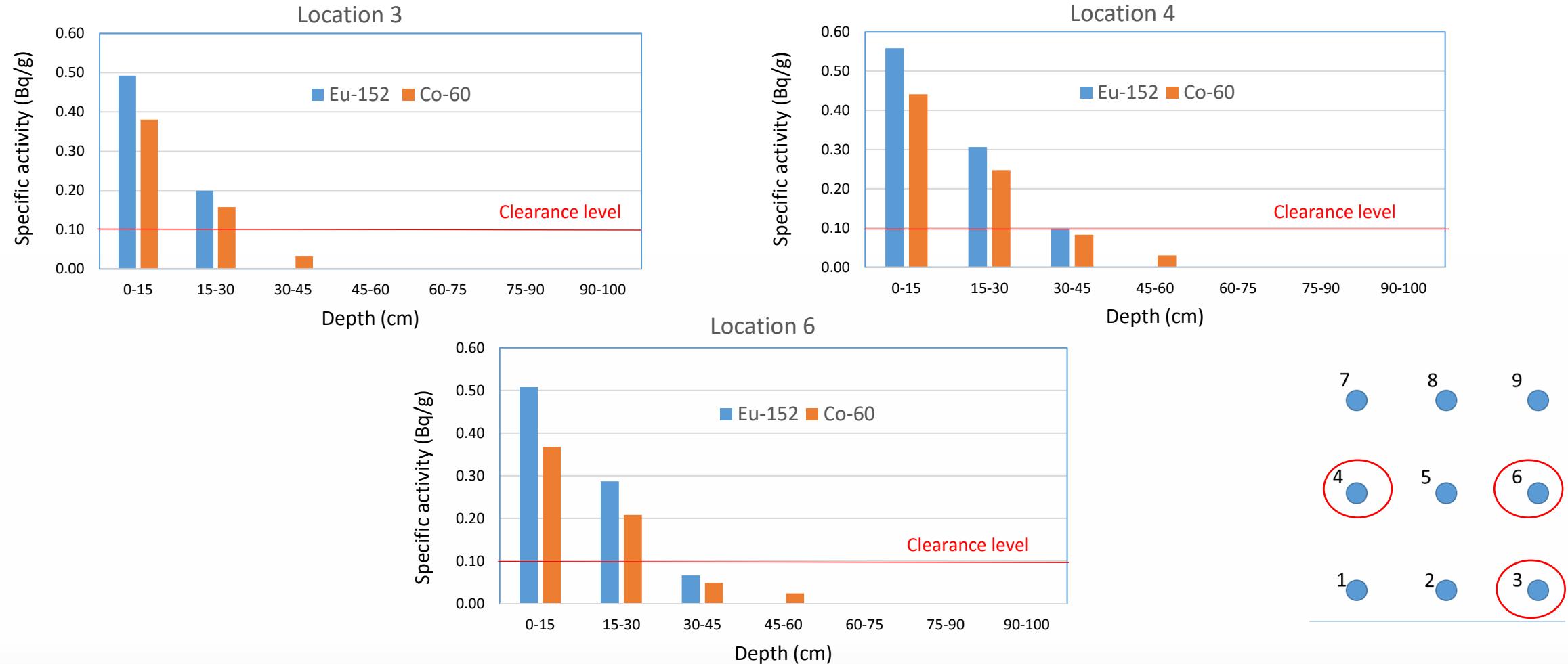


First analysis of concrete rods

- Three locations in front of target 3 and target 4 (location 3, 4 and 6)
- Characterisation of rods with ISOCS™
- MDA's: 0.03-0.06 Bq/g (2h counting time)

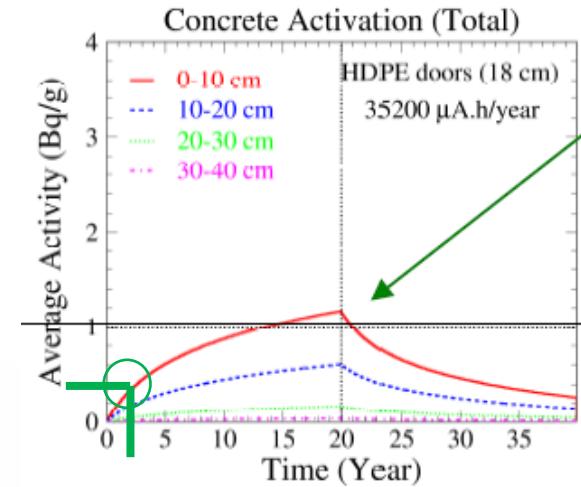


First analysis of concrete rods



Efficacy of shielded doors

- Measurement results in line with predicted data



- Activation > clearance levels after two years of routine production
- Impact on other walls to be investigated

Some discussion points

- Cost-effectiveness after reducing activation level by a factor of 2-3?
- Activation > clearance level
Real impact on future decommissioning strategies?
- Lessons for new installations?