

Fire- and explosion safety programme and a case study on acceptance criteria to open smoke hatches

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Location



Under construction

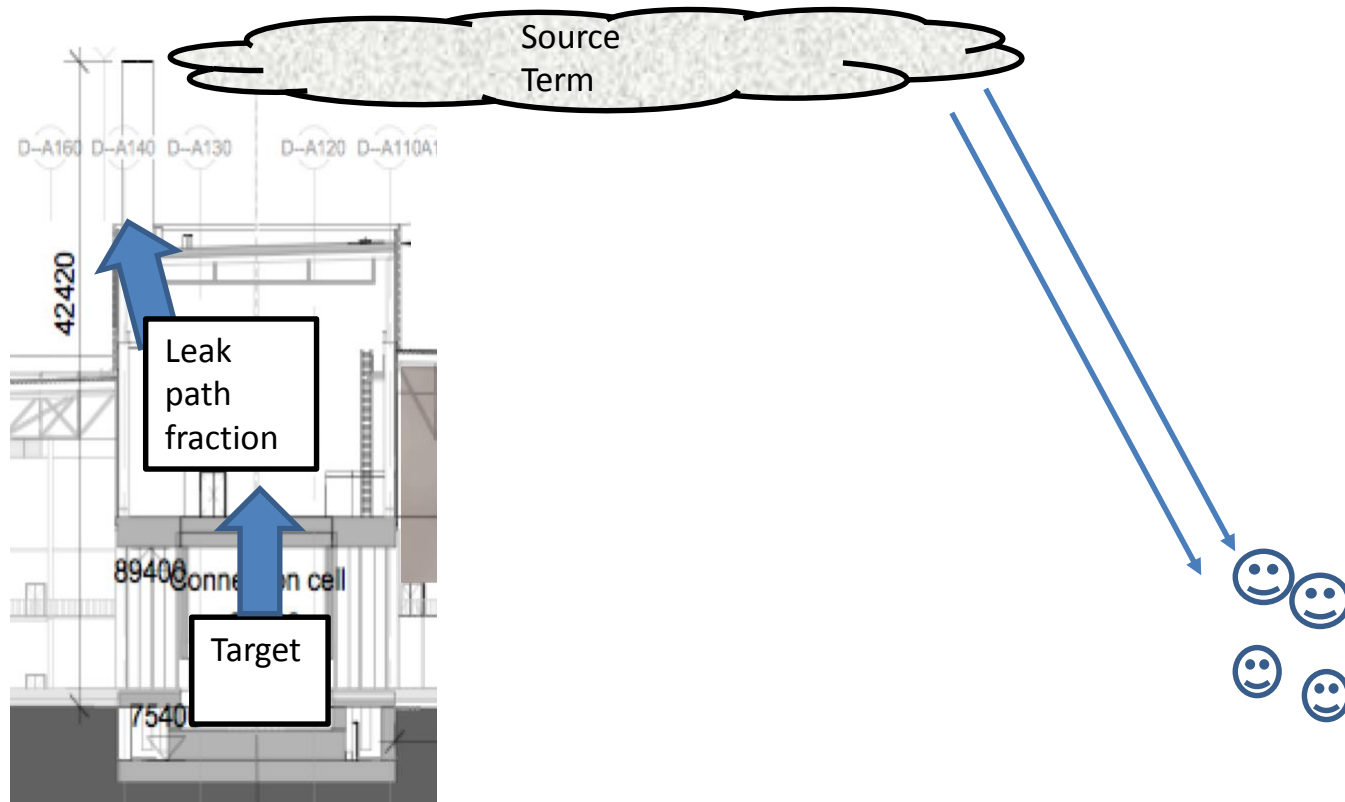
Public
Instrument
Target
Accelerator



Risk assessment - conventional



Risk assessment - radiological



Regulatory Conditions

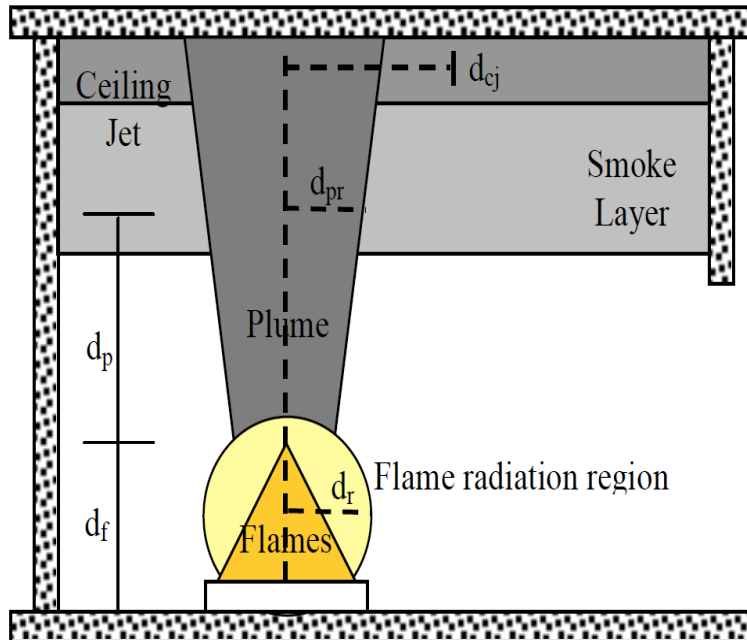


Demonstrate how to avoid:

> 0,1 mSv to public within a return time of 100 years

We have to predict the future fire scenarios!

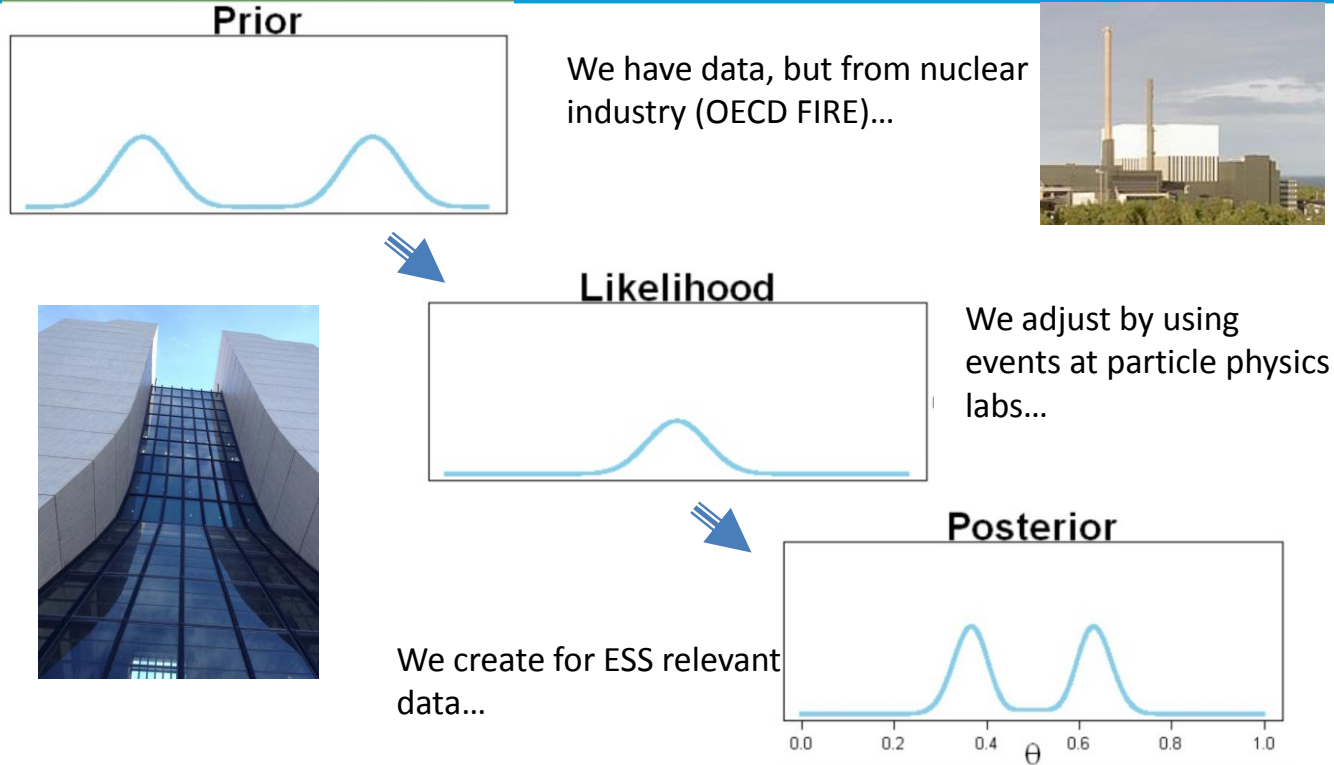
Assessment



Experience



Bayesian model – to predict the future



Bayesian updating from a priori to posteriori

Data from Department of Energy

Component Type	Prior Freq. OECD μ_{Λ}	ST. Dev. σ_{Λ}	#components	#Events	#Events/Component s	μ''_{Λ}	σ''_{Λ}	ANL	FEMP	SLAC	LANL	TJNA F	BNL	ORNL	FNAL
High voltage transformer	3.30E-04	9.90E-04	77	1	1.30E-02	3.55E-04	1.01E-03	1							
Diesel generator	4.20E-04	1.26E-03	31.5	0	0.00E+00	4.00E-04	1.20E-03								
Low/Medium Voltage transformer	5.60E-05	1.68E-04	332.5	0	0.00E+00	5.56E-05	1.67E-04								
Electrical cabinet	7.00E-06	2.10E-05	2415	11	4.55E-03	7.28E-06	2.14E-05	1	1	4			4		1
Electrical driven pump	8.70E-06	2.61E-05	997.5	1	1.00E-03	8.77E-06	2.62E-05	1							
Rectifier and inverter	3.30E-05	9.90E-05	28	0	0.00E+00	3.29E-05	9.86E-05								
Heater	6.50E-06	1.95E-05	332.5	1	3.01E-03	6.67E-06	1.97E-05							1	
Fan	2.70E-05	8.10E-05	1060.5	0	0.00E+00	2.69E-05	8.07E-05								
Battery			210	0											
Modulator with capacitor-cabinet			357	0											
Klystron			707	0											
Filter HEPA			35	0											
Filter Carbon				0											
Switchgear				1				1							
Magnets				3				1			1	1			
Computer				1										1	
Cigarette				1						1					
Normal Items				1										1	
Animals				1							1				

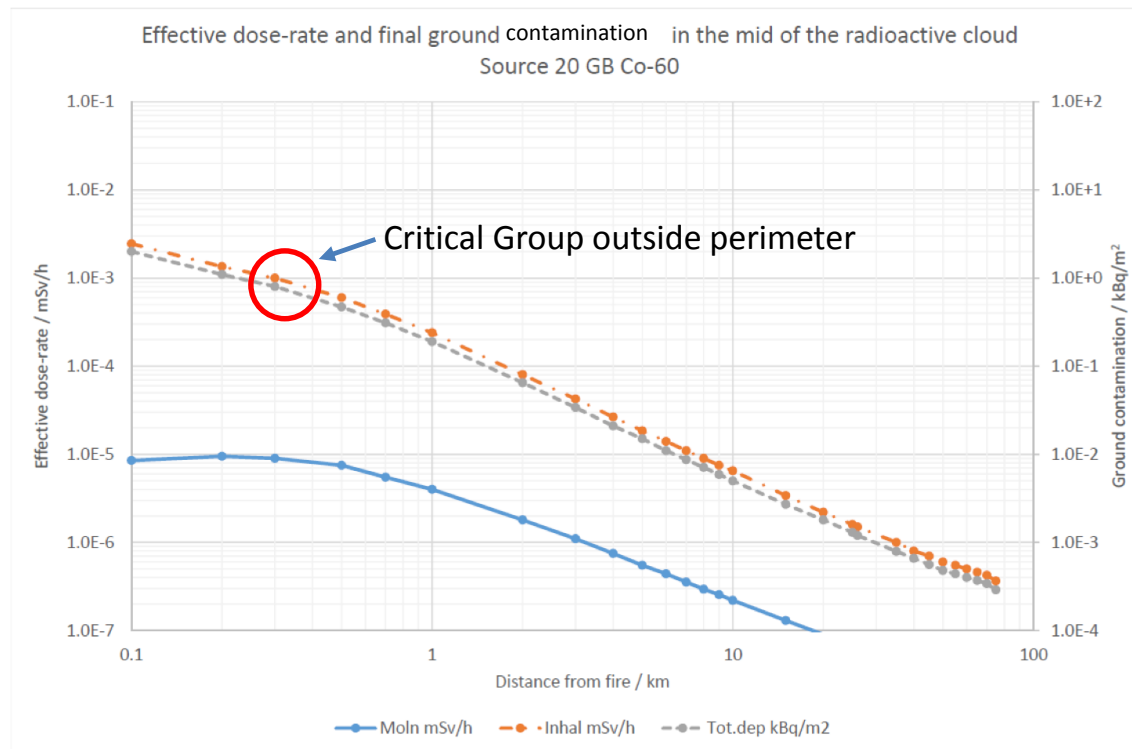
↑ Prior

↑ Posterior

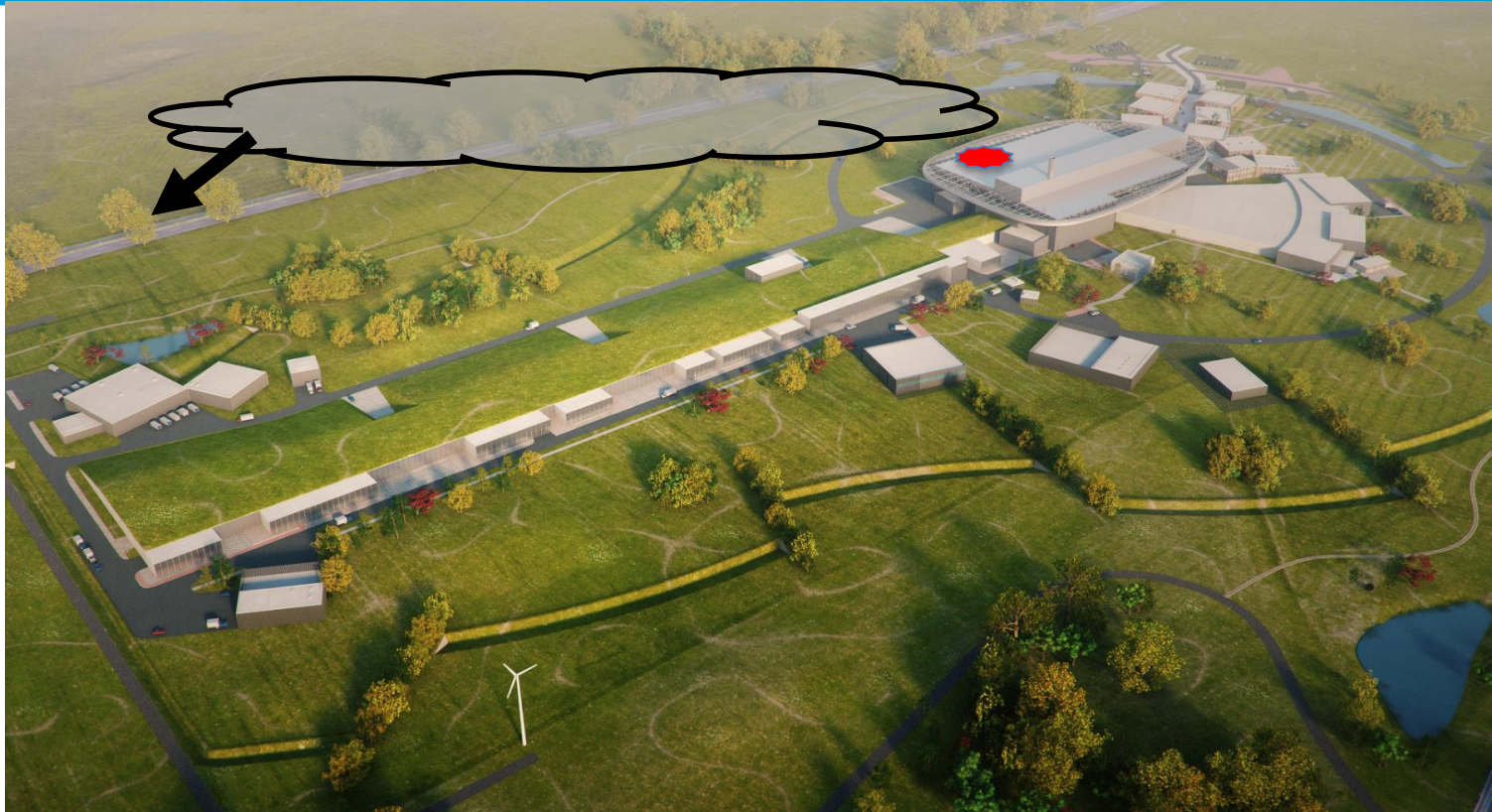
Case study – Can we just open the smoke hatches ?



Dose rates along the cloud central line



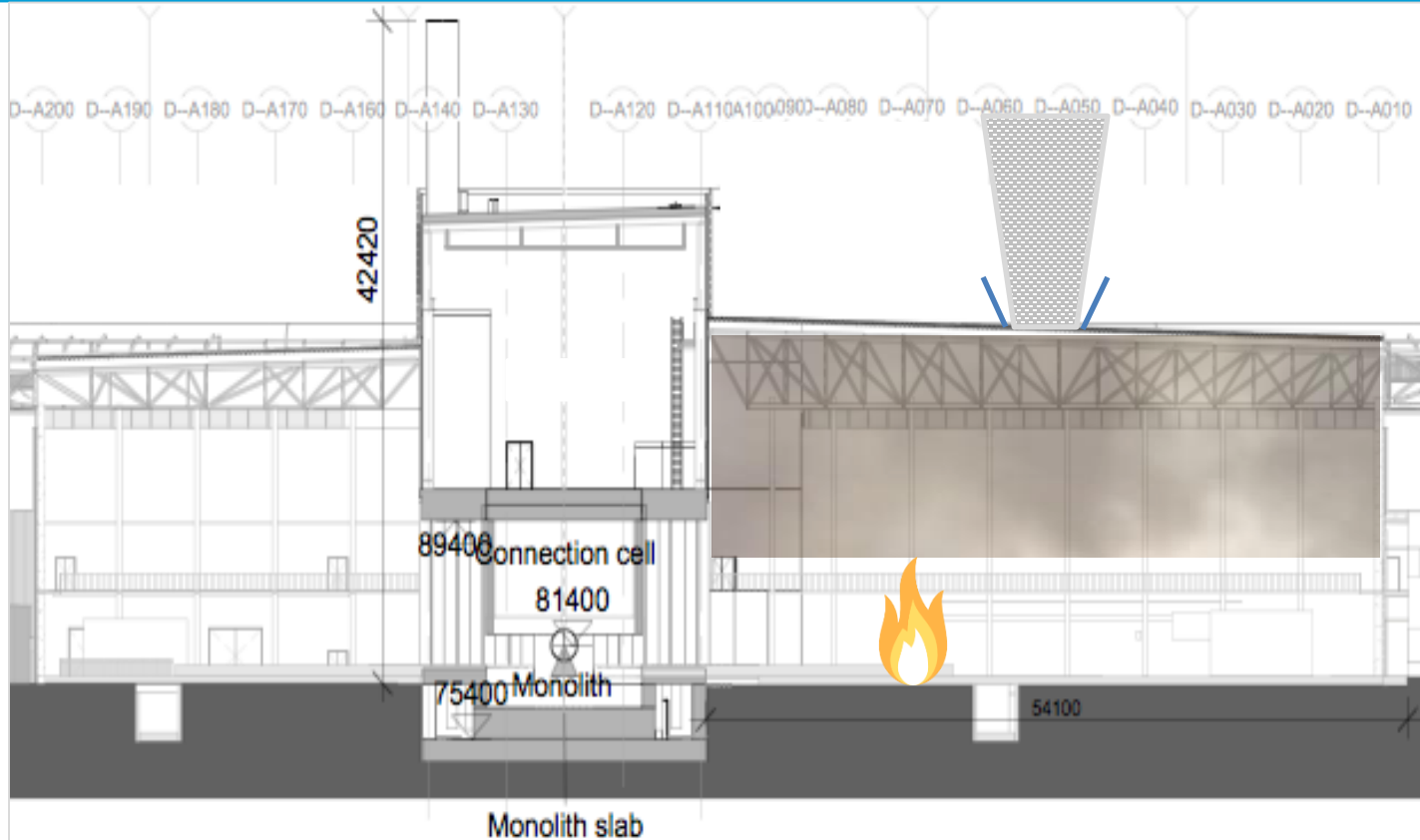
Total effective dose: $\ll 0,1\text{mSv}$



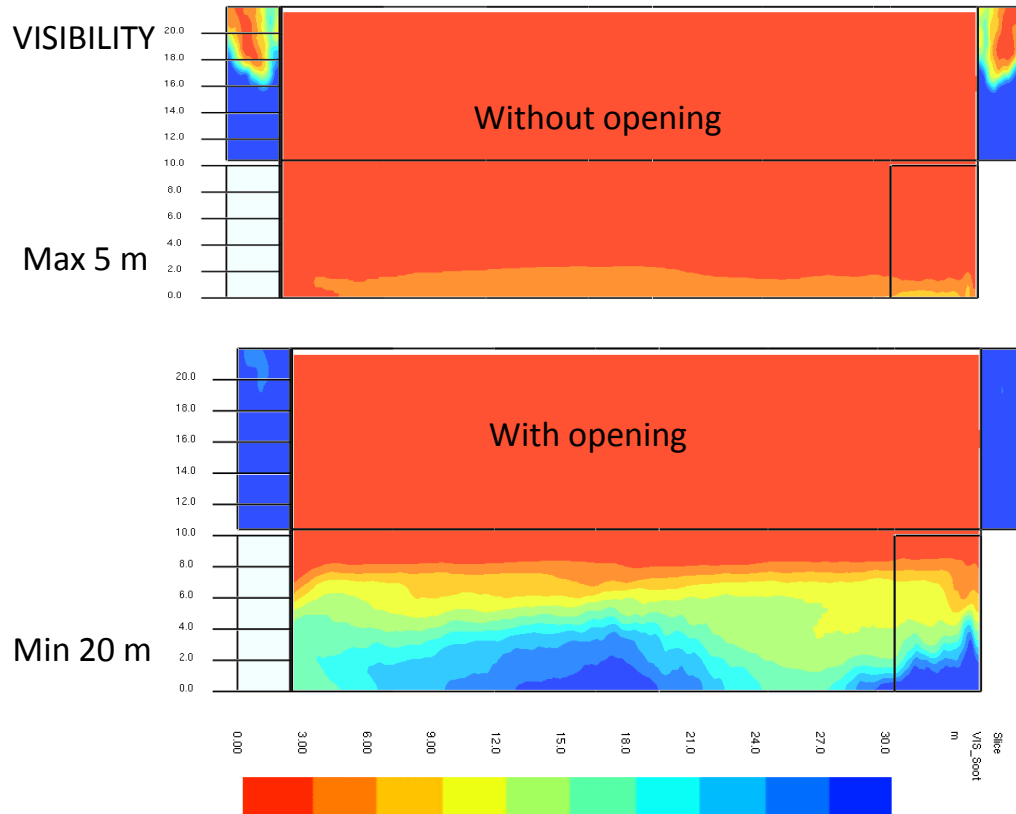
Case closed!?

<u>Event class</u> (mSv)	<u>Reference value</u>
Anticipated events (H2)	0.1
Unanticipated events (H3)	1.0
Improbable events (H4A)	20
Events with multiple failures (H4B)	20
Highly improbable events (H5)	100

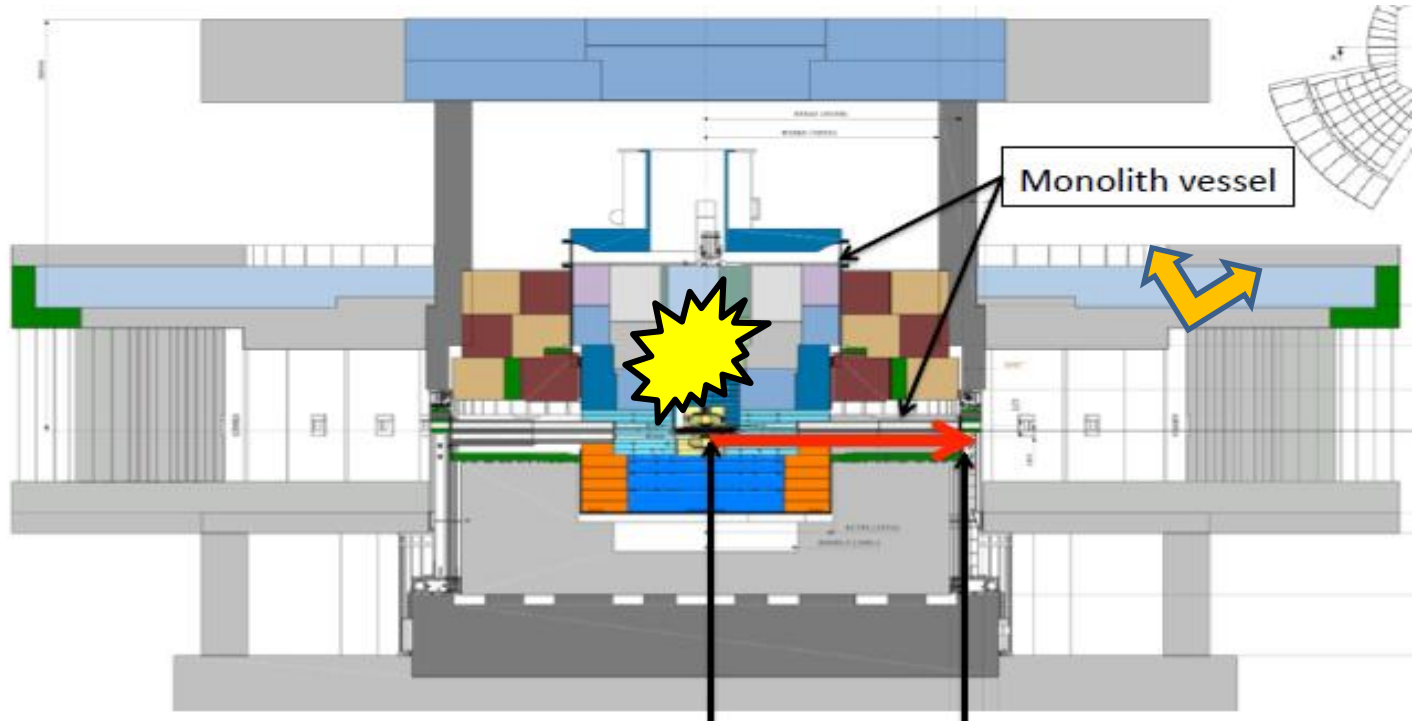
ALARA – Do we really need to open the smoke hatches?



Smoke hatches helps – but still dependent from BA



Is there possibility for worse consequence but less frequent?



How many particles will leave the instrument hall through the smoke hatches?

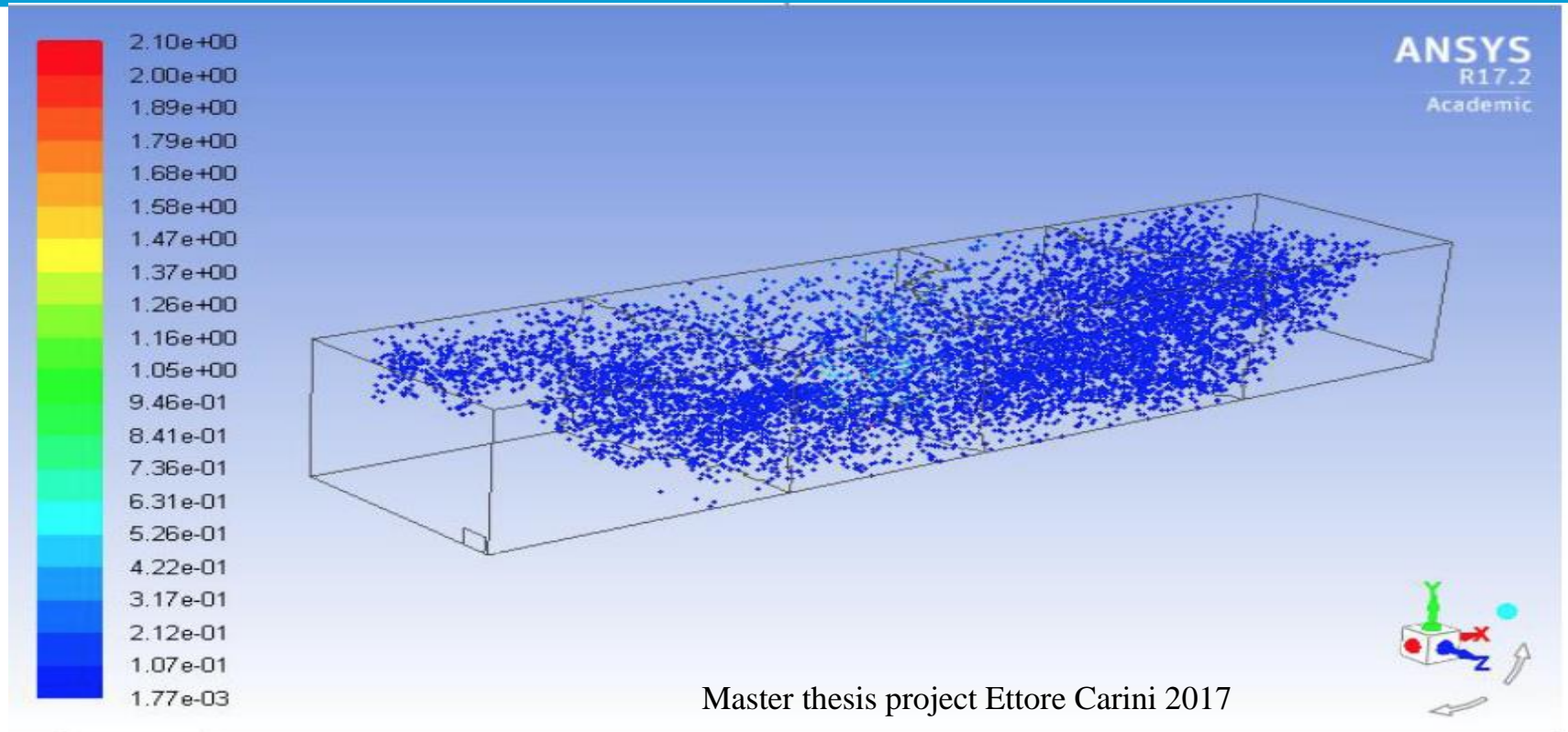


Figure 27 Isometric view of the particles in the hall after 20 minutes

Minimize rescue workers exposure



Rough conclusion for design



Can not have fire-risks in the facility which are **anticipated** (return time 100 years).....

.....if the consequence may exceed 0,1 mSv to anybody

Statistics is useless if we cannot validate the circumstances

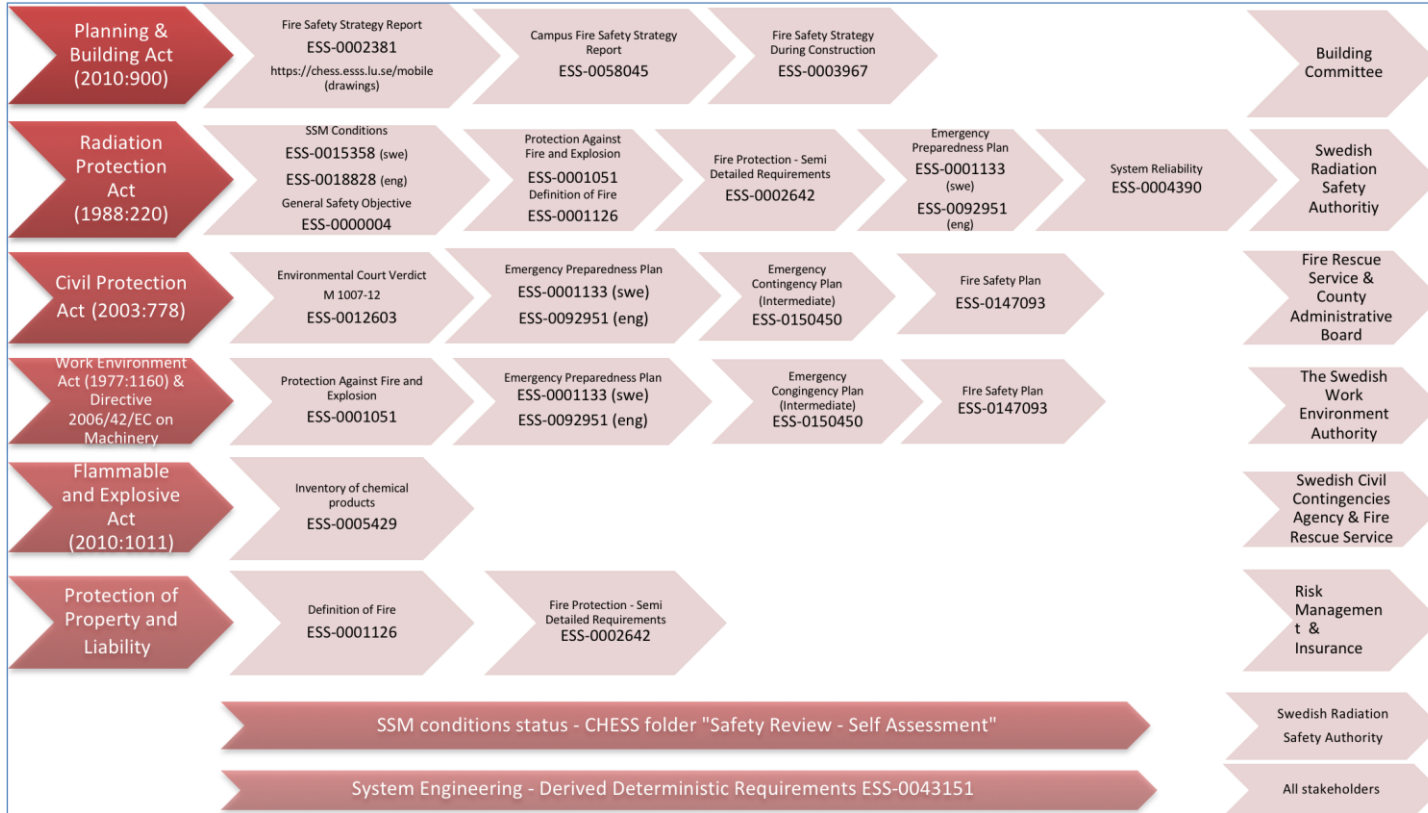
If data is based on this....



Is no good to justify this.....



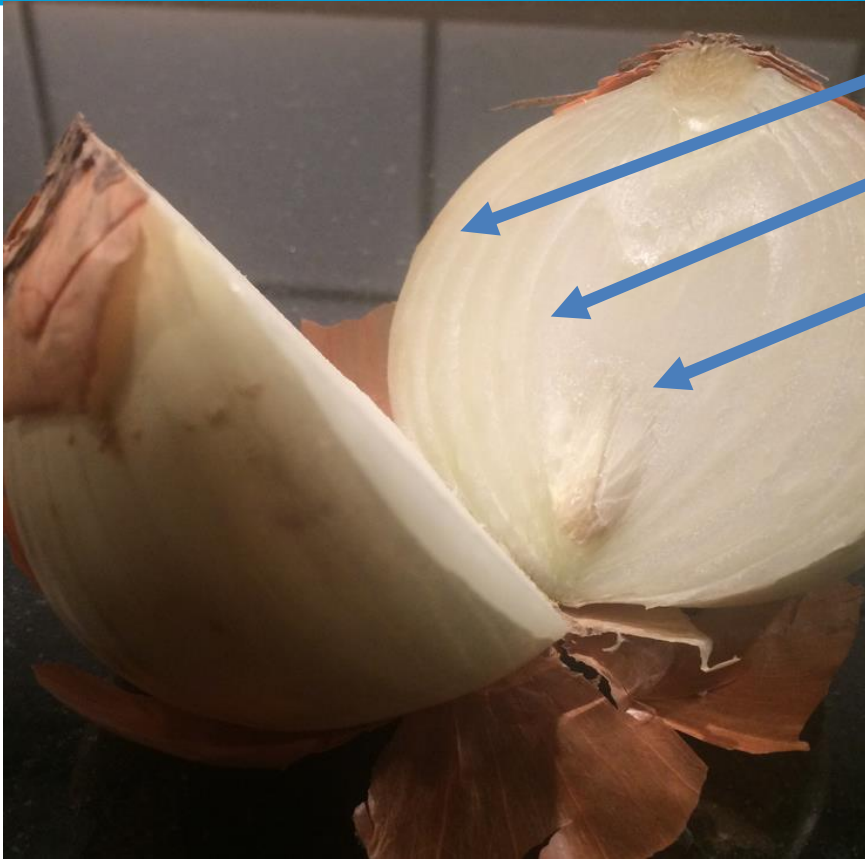
We need a programme....



BUILDING - & OPERATIONS PERMIT

Deterministic fundamentals...

Defence-in-depth



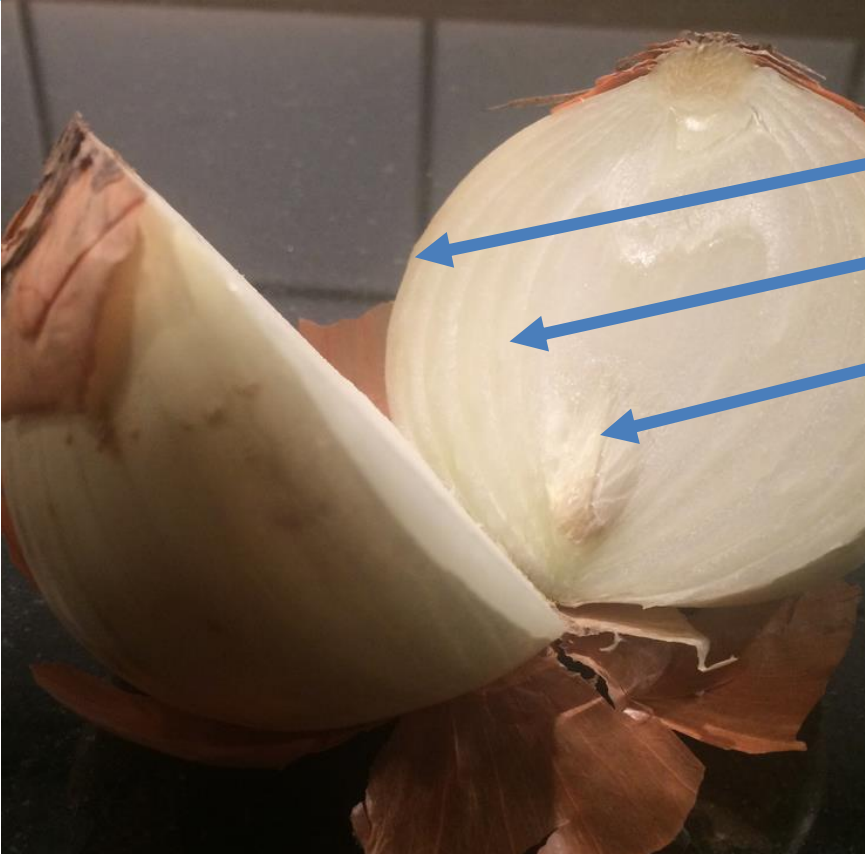
Prevent start

Detect & quickly extinguish

Prevent spread

Explosion...

Defence-in-depth



Prevent occurrence

Minimize the risk, if expl. atmosphere
cannot be avoided

Limit consequences

Thank you