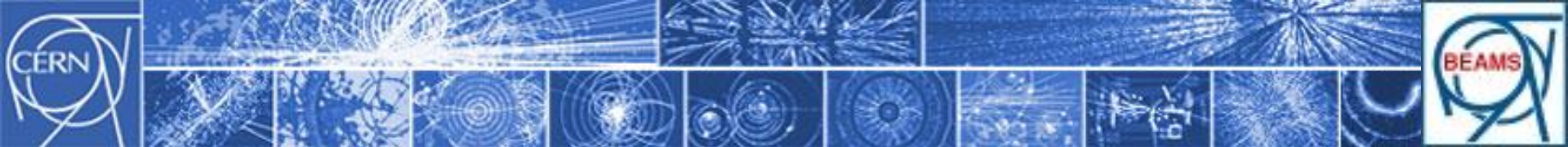


## General Safety requirement:

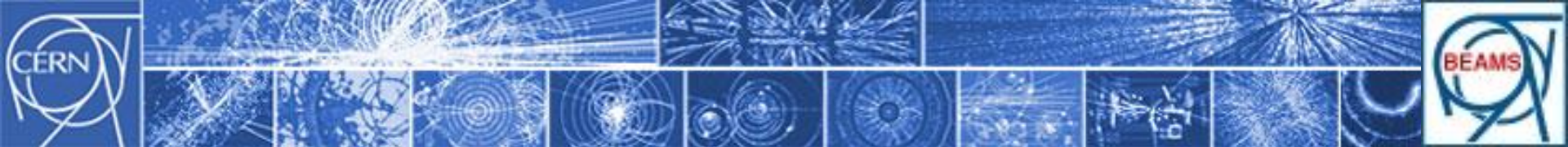
“Show that the facility will not expose any person to harm or danger, or have an adverse effect on the environment, at any phase of the construction, operation, dismantling and disposal, in normal operation or under degraded conditions.”



..probably not easy, so:

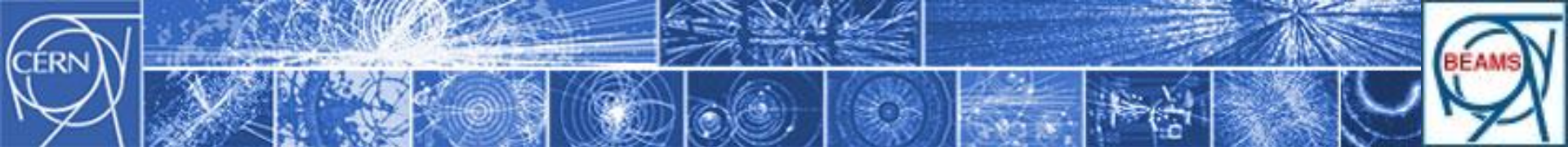
Demonstrate compliance with all relevant laws; a non-exhaustive list is given by HSE in the safety file requirements (60 pages).

...also not easy: the process is to identify potential hazards, estimate their gravity and apply adequate control measures to reduce the risk to acceptable levels.



For the production area the hazards noted so far are:

Ingress + Egress; access control and evacuation.  
Ventilation; cooling, control and confinement (+/- $\delta P$ ?) of activated airs in normal, operation and fire conditions.  
Mechanical handling, lifting, cranes. Electrical and fire risks. Target area He cooling (+/- $\delta P$ ?): procedures for access, flushing, sealing, monitoring and costs. Decay line construction, He cooling (+/- $\delta P$ ?), integrity of chamber (post construction access), monitoring, recirculating activated gas, thermal cycling stresses, actions when leaks develop, flushing, decommissioning and disposal....



# Flushing, cooling, leaks, access, +/- $\delta P$ , procedures and costs...

## Data for Operational Radiation Protection

Nuclide	Half-life	Type of decay/ radiation	Assessment quantities					Exemption limit	Licensing limit	Guidance values		
			$\dot{e}_{inh}$ Sv/Bq	$\dot{e}_{ing}$ Sv/Bq	$h_{10}$ (mSv/h)/GBq at 1 m	$h_{0,07}$ (mSv/h)/GBq at 10 cm	$h_{c0,07}$ (mSv/h)/ (kBq/cm <sup>2</sup> )	LE Bq/kg or LE <sub>abs</sub> Bq	LA Bq	CA Bq/m <sup>3</sup>	CS Bq/cm <sup>2</sup>	Unstable daughter nucli
1	2	3	4	5	6	7	8	9	10	11	12	13
H-3	12.35 y	$\beta^-$	4.1 E-11	4.2 E-11	<0.001	<1	<0.1	2 E+05	1 E+08	2 E+05		1000
H-3, HTO	12.35 y	$\beta^-$	1.8 E-11	1.8 E-11	<0.001	<1	<0.1	6 E+05	3 E+08	5 E+05		1000
H-3, gas [7]	12.35 y	$\beta^-$	1.8 E-15		<0.001	<1	<0.1		3 E+12	5 E+09		
Be-7	53.3 d	$\epsilon, \gamma$	4.6 E-11	2.8 E-11	0.008	<1	0.1	4 E+05	1 E+08	1 E+05		1000
Be-10	1.6 E6 y	$\beta^-$	1.9 E-08	1.1 E-09	<0.001	2000	1.6	9 E+03	3 E+05	9 E+01		3
C-11	20.38 m	$\epsilon, \beta^+$	3.2 E-12	2.4 E-11	0.160	1000	1.7	4 E+05	7 E+07	7 E+04	[3]	3
C-11 monoxide	20.38 m	$\epsilon, \beta^+$	1.2 E-12	1.2 E-12					7 E+07	7 E+04	[3]	
C-11 dioxide	20.38 m	$\epsilon, \beta^+$	2.2 E-12	2.2 E-12					7 E+07	7 E+04	[3]	
C-14	5730 y	$\beta^-$	5.8 E-10	5.8 E-10	<0.001	200	0.3	2 E+04	9 E+06	1 E+04		30
C-14 monoxide	5730 y	$\beta^-$	8.0 E-13	8.0 E-13					6 E+09	1 E+07		
C-14 dioxide	5730 y	$\beta^-$	6.5 E-12	6.5 E-12					8 E+08	1 E+06		
N-13	9.965 m	$\epsilon, \beta^+$			0.160	1000	1.7		7 E+07	7 E+04	[3]	3

Swiss law; can release under exemption limit, so regular flushing? French law does not allow release so actions in case of leaks? Costs and alternate scenario if N2 cooling used with regular flushing (avoids ozone issues only). Cooling system with filters?