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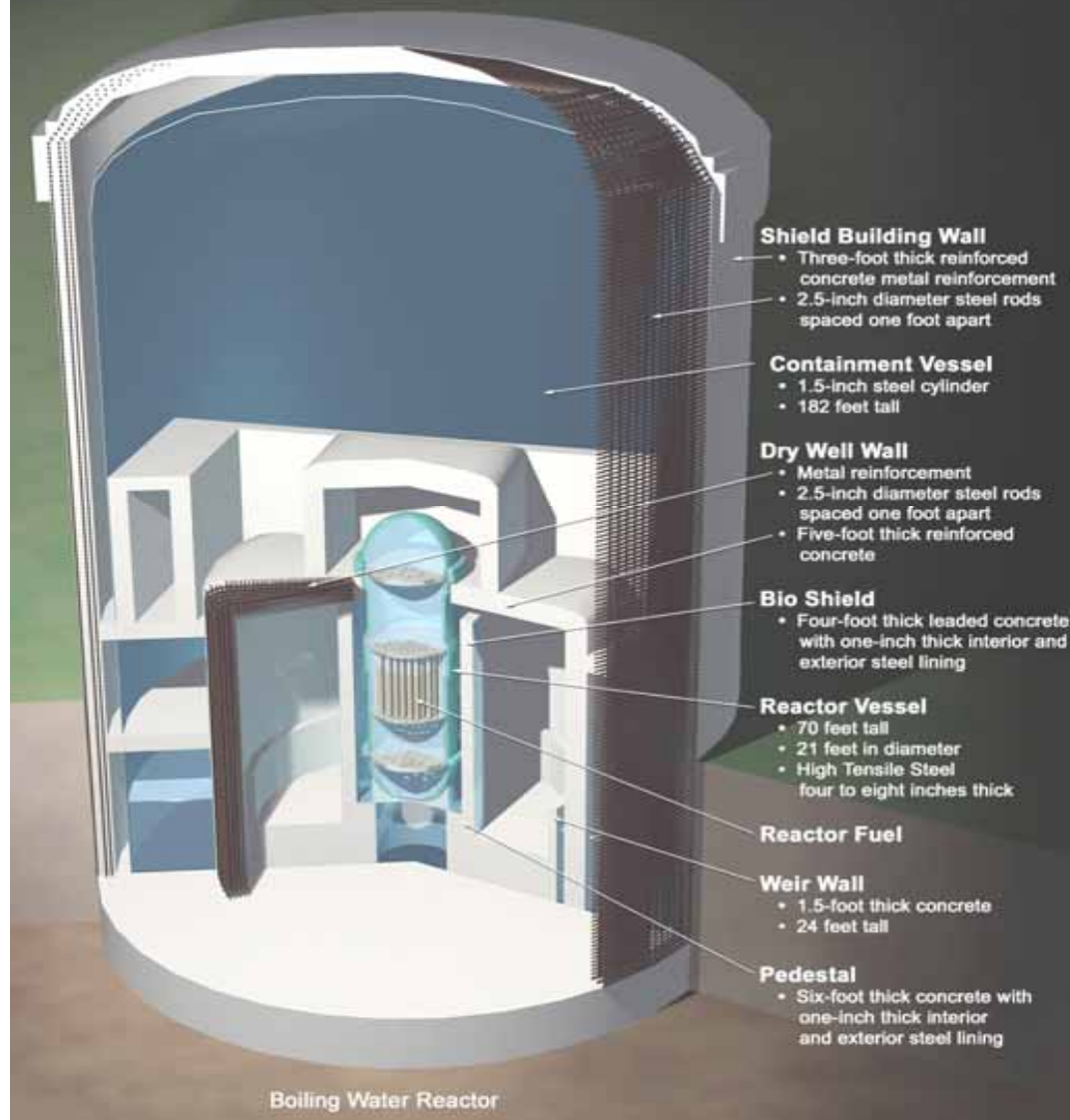
Typical Radioactivity Inventory for a 1000MWe NPR
Acceptance criteria for the ECCS

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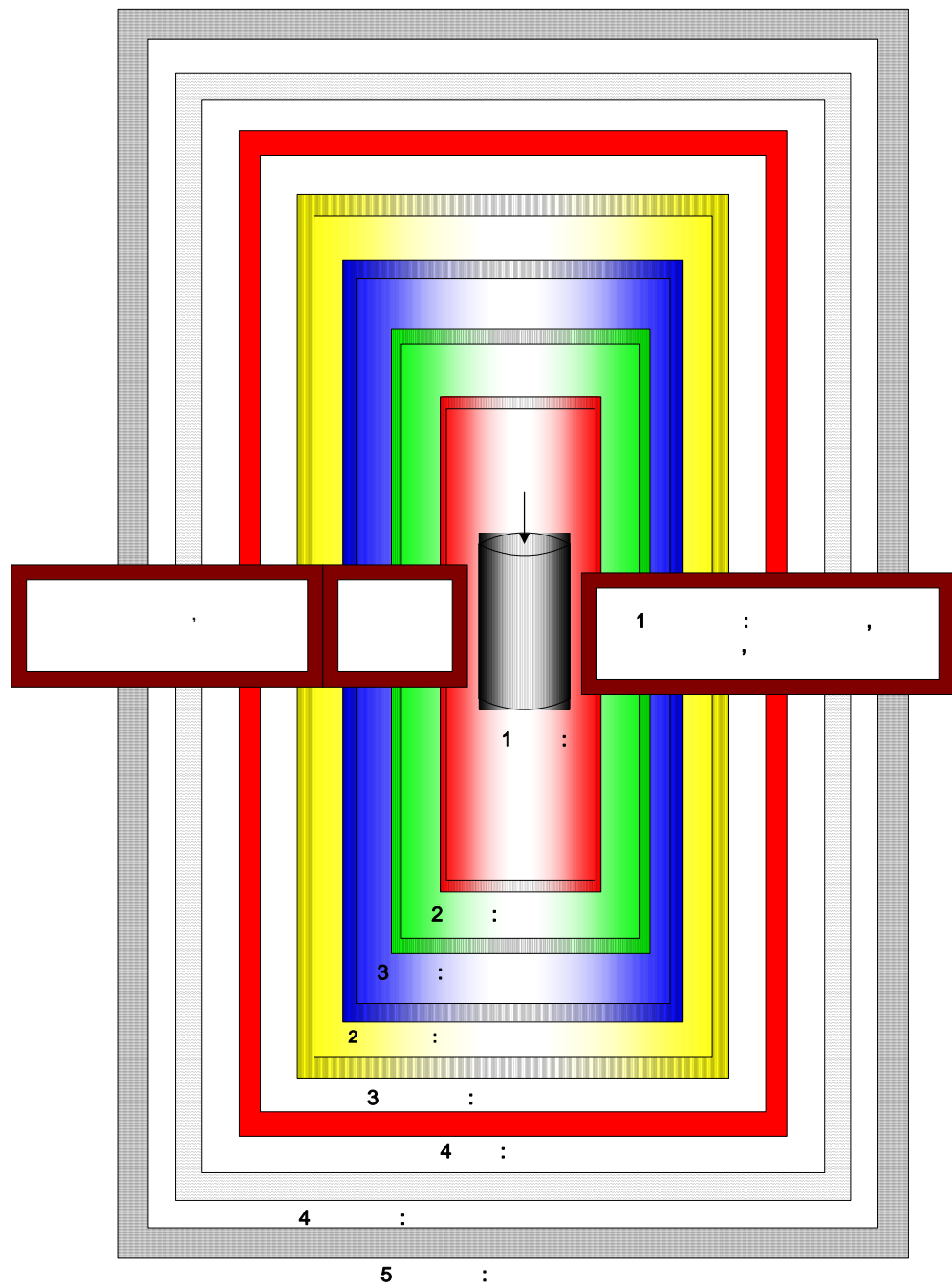
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ICRP 1977 1990

Multiple Layers of Safety at Nuclear Power Plants



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Typical Radioactivity Inventory for a 1000 MWe Nuclear Power Reactor

Location	Total Inventory (Curies)			Fraction of Core Inventory		
	Fuel	Gap	Total	Fuel	Gap	Total
Core ^(a)	8.0×10^9	1.4×10^8	8.1×10^9	9.8×10^{-1}	1.8×10^{-2}	1
Spent Fuel Storage Pool (Max.) ^(b)	1.3×10^9	1.3×10^7	1.3×10^9	1.6×10^{-1}	1.6×10^{-3}	1.6×10^{-1}
Spent Fuel Storage Pool (Avg.) ^(c)	3.6×10^8	3.8×10^6	3.6×10^8	4.5×10^{-2}	4.8×10^{-4}	4.5×10^{-2}
Shipping Cask ^(d)	2.2×10^7	3.1×10^5	2.2×10^7	2.7×10^{-3}	3.8×10^{-5}	2.7×10^{-3}
Refueling ^(e)	2.2×10^7	2×10^5	2.2×10^7	2.7×10^{-3}	2.5×10^{-5}	2.7×10^{-3}
Waste Gas Storage Tank	-	-	9.3×10^4	-	-	1.2×10^{-5}
Liquid Waste Storage Tank	-	-	9.5×10^1	-	-	1.2×10^{-8}

- (a) Core inventory based on activity $\frac{1}{2}$ hour after shutdown
- (b) Inventory of $\frac{2}{3}$ core loading; $\frac{1}{3}$ core with three day decay and $\frac{1}{3}$ core with 150 day decay
- (c) Inventory of $\frac{1}{2}$ core loading; $\frac{1}{6}$ core with 150 day decay and $\frac{1}{3}$ core with 60 day decay
- (d) Inventory based on 7 PWR or 17 BWR fuel assemblies with 150 day decay
- (e) Inventory for one fuel assembly with three day decay

ACCEPTANCE CRITERIA FOR THE ECCS

The general requirement for ECCS for light water reactors (LWR), as given in 10 CFR 50.46, are follows :

1. Peak Clad Temperature

The calculated maximum fuel-element cladding temperature does not exceed 2200 °F

2. Maximum Cladding Oxidation

The calculated total oxidation of the cladding nowhere exceeds 17% of the total thickness before oxidation.

3. Maximum Hydrogen Generation

The calculated total amount of hydrogen generated from the chemical reaction of the cladding with or steam does not exceed 1% of the hypothetical amount that would be generated if all the metal in the cladding surrounding the plenum volume were to react.

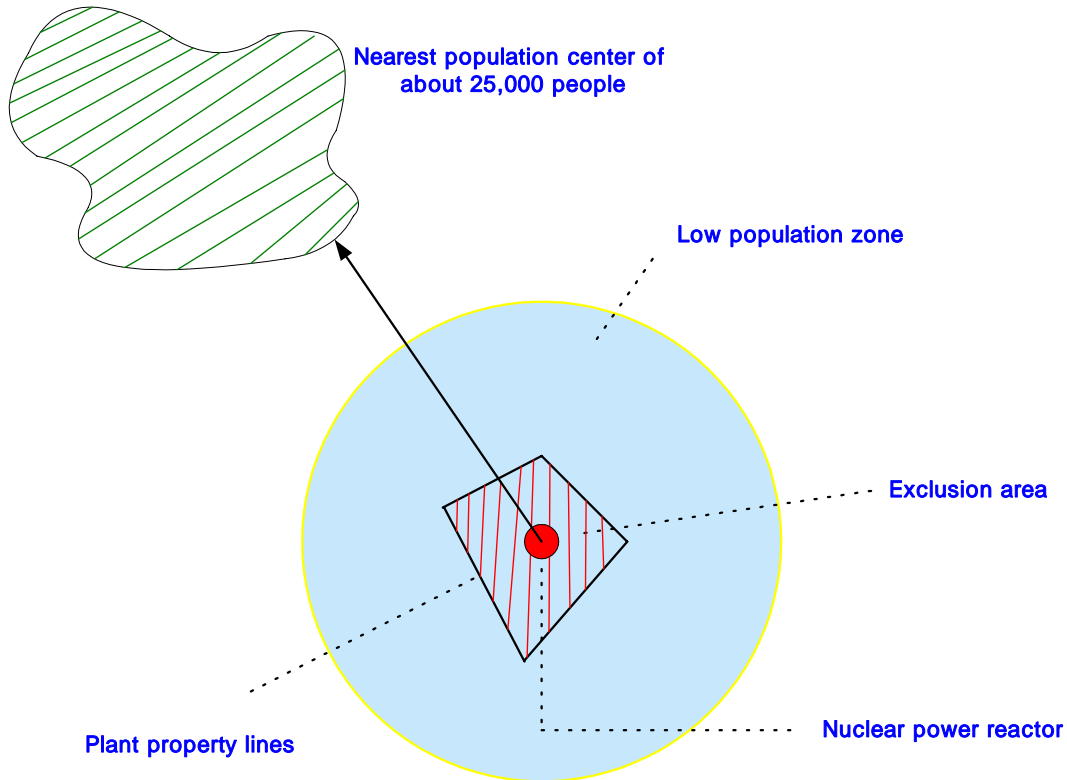
4. Coolable Geometry

Calculated changes in core geometry are such that the core remains amenable to cooling

5. Long-Term Cooling

After any calculated successful initial operation of the ECCS, the calculated core temperature is maintained at an acceptably low value and decay heat is removed for the extended period of the required by the long-lived radioactivity remaining in the core

Schematic of the various distance and zoning requirement



- (1) At boundary of exclusion area, no member of public may exceed 25 rems whole-body dose for design basis accident**
- (2) Timely evacuation of low population zone must be planned.**
- (3) Population center must be at least $1 \frac{1}{3}$ times farther away than LPZ boundary**

(Site)

(Exclusion Area)

(10CFR100.3)

(EA) 가 ,
가 .

가 가
25 rem , iodine
300 rem

(Low Population Zone)

(10CFR100.3)

EA
가 ,

LPZ 가
25 rem , iodine 300 rem

(Population Center Distance)

25,000

NRC “ ” “ (LPZ)” 1.33

	SI				
	(Bq)	1 1	(Ci)	1 3.7x10 ¹⁰	1Bq=2.7x10 ¹⁰ Ci
	C/Kg	1Kg 1 X()	R	1 0 °C 1cm ³ 1 esu X()	1 C/kg = 3876 R
	(Gy)	1kg 1 (J)	(rad)	1 100erg 가	1 Gy = 100rad
가	(Sv)	X (Gy) X	(rem)	X (rad) X	1 Sv = 100 rem

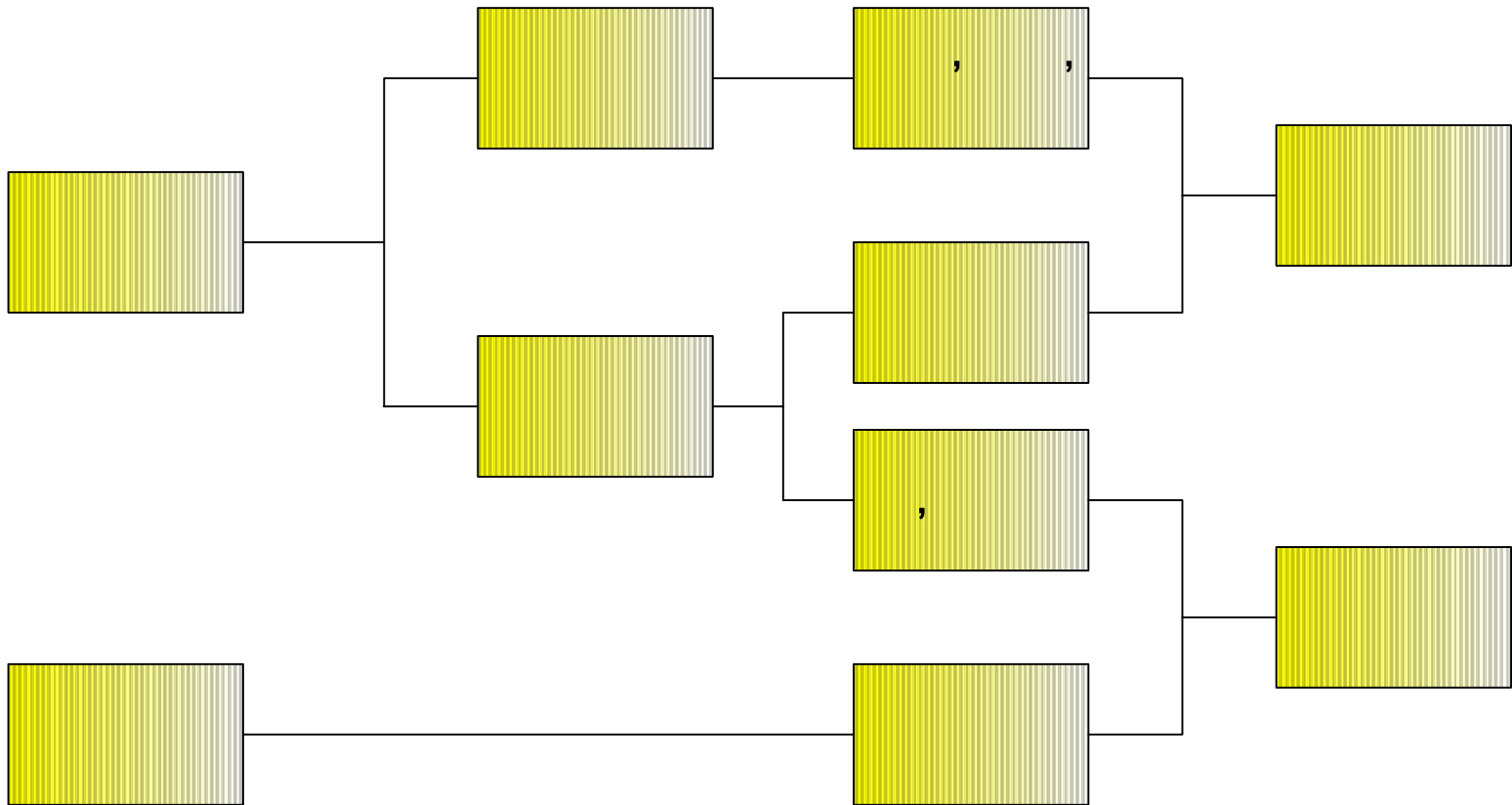
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	가, W_T
(Gonads)	0.20
(Red Bone Marrow)	0.12
(Colon)	0.12
(Lung)	0.12
(Stomach)	0.12
(Bladder)	0.05
(Breast)	0.05
(Liver)	0.05
(Oesophagus)	0.05
(Thyroid)	0.05
(Skin)	0.01
(Bone Surface)	0.01
(Remainder)	0.05

		0.15 Gy (15 rad)	0.4 Gy/ (40 rad/)
		3.5-6 Gy (350-600 rad)	2.0 Gy/ (200 rad/)
		2.5-6 Gy (250-600 rad)	0.2 Gy/ (20 rad/)
		0.6-5 Gy (60-500 rad)	0.15 Gy/ (15 rad/)
		0.5 Gy (50 rad)	-
	,	5 Gy (500 rad)	-
		20 Gy (2000 rad)	-
		50 Gy (5000 rad)	-

Sv	rem		
0.25	25		
0.25 – 1.0	25 – 100		
1.0 – 2.0	100 – 200	, , , , , , 90	
2.0 – 3.0	200 – 300		
4.5	450	30	50%
7.0	700	30	100%
10.0	1000	1 - 2	



ICRP 1977 1990

		ICRP-26(1977)	ICRP-60(1990)
	() ()	. 50mSv/yr .	. 5 20mSv/yr(1 50mSv/yr) . 가
	, , , , ,	0.155Sv/yr 0.55Sv/yr	150mSv/yr 500mSv/yr , ,
		. 50mSv/yr . B(1/30)	. , () 2mSv . 1/20
		.1 2 . 5	
			. 0.5Sv 5Sv .
		. 1mSv/yr 5mSv/yr 50mSv/yr	. 1mSv/yr . 가 15mSv/yr 50mSv/yr

	ICRP - 60 (mSv/)	(mSv/)				
	1.0	0.25	0.0075	0.0027	0.00015	0.0015
	-	0.75	0.0343	3.19×10^{-6}	0.00017	0.0015
	50.0	0.25	0.0133		0.00015	0.0014
		0.25	0.0073		0.00018	0.0125