

Activation Analysis **for** **ARIES-AT Divertor**

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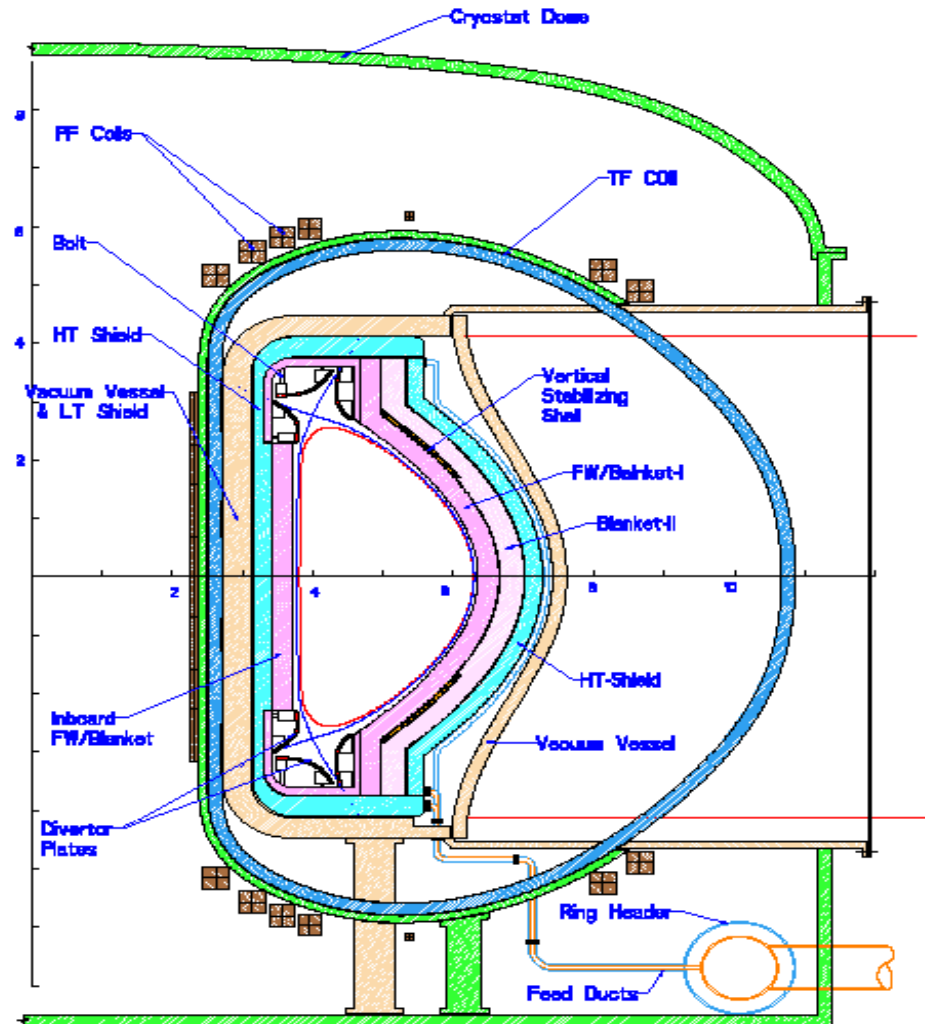
http://fti.neep.wisc.edu/FTI/ARIES/JUN2000/divertor_abdou.pdf

ARIES Project meeting
19 – 21 June 2000, UW-Madison



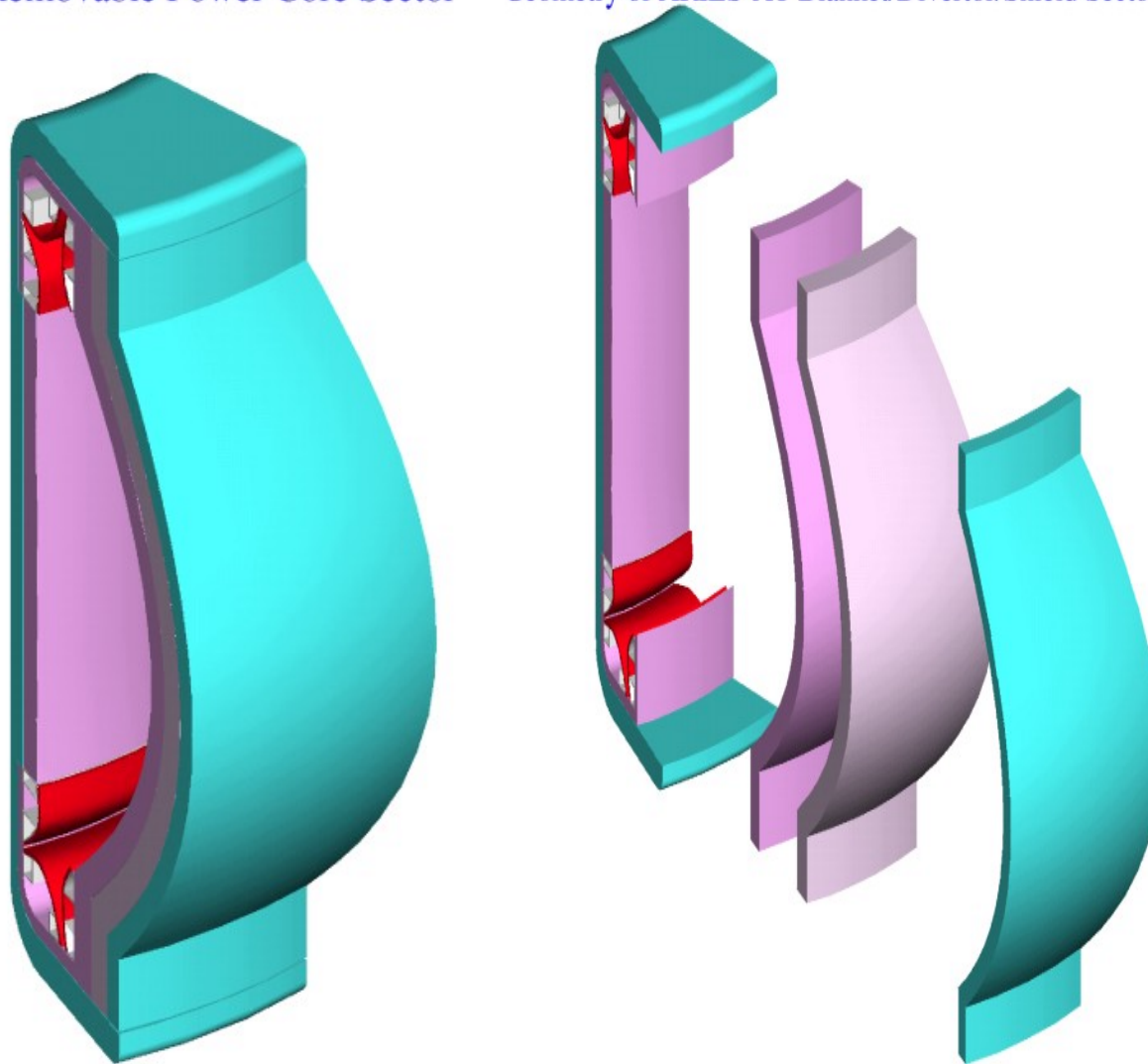
ARIES-AT

Cross Section of ARIES-RS Power Core Configuration

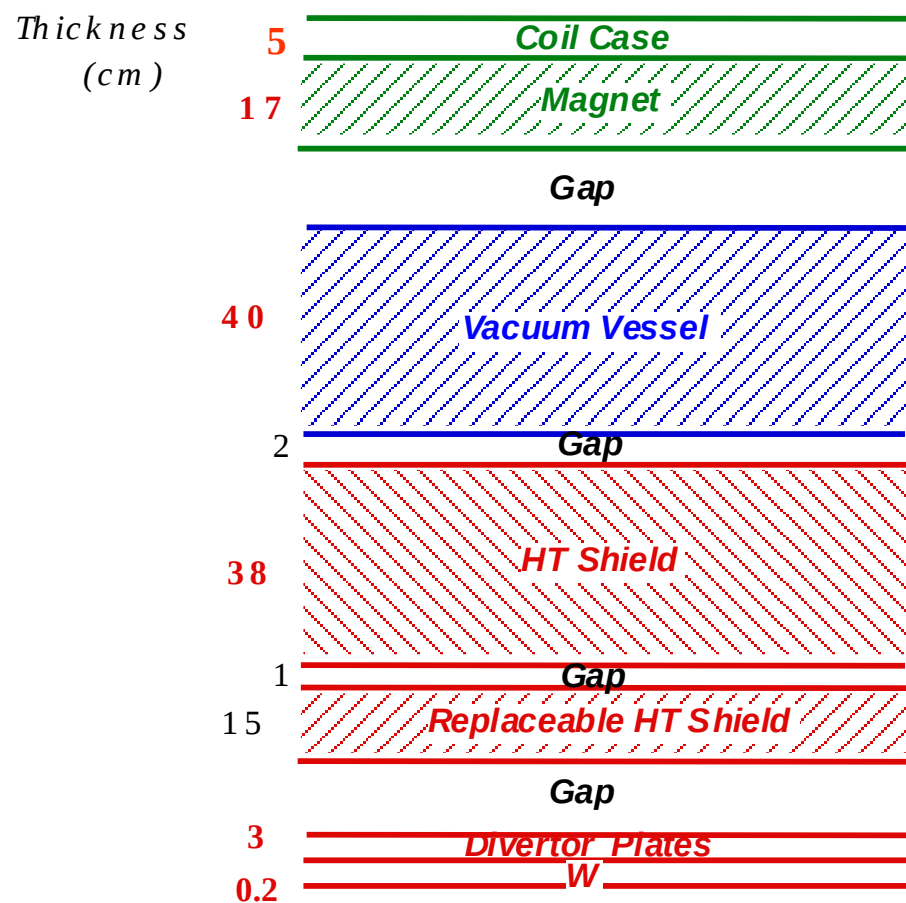


ARIES-AT Divertor 3D

ARIES-AT Removable Power Core Sector Geometry of ARIES-AT Blanket/Divertor/Shield Sector



ARIES-AT Vertical Build



Vertical Build Composition

Component

Composition

W-coating

100% W

Divertor plates

46% SiC, 54% LiPb

Repl shield

15% SiC, 10% LiPb, 75% FS

HT shield

15% SiC, 10% LiPb, 75% B-FS

Vacuum vessel

13% FS, 22% H₂O, 65% B-FS

HT magnet

87% SS, 10% LN, 2.5% Y₁Ba₂Cu₃O₅, 0.5% Ag

SiC and WC are 95% dense



Activation Analysis

Codes

- DANTSYS code for flux generation; Using FENDL-2 Xs data
- ALARA code for activation; Using FENDL-2 activation library

Model

- 175 n and 42 γ group structures
- Pulsed operation for 4 and 40 FPY with 75% availability

Results reported here are for

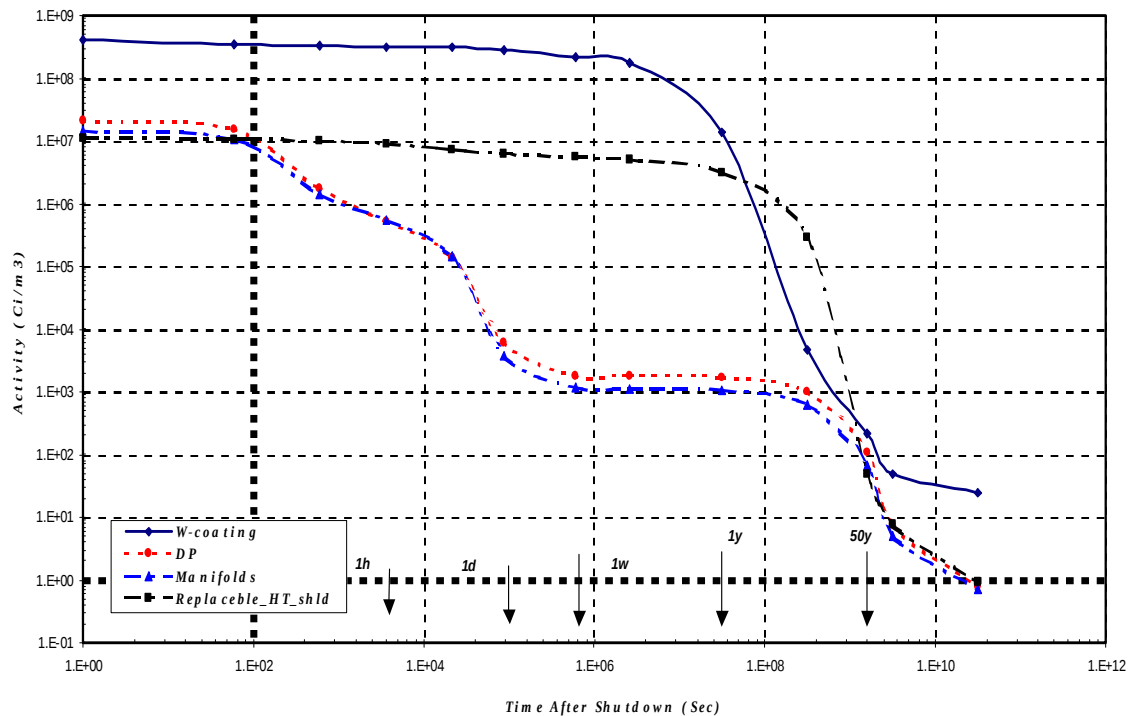
- 100% dense compacted waste (excluding coolants and void)
- SiC, WC, and LiPb compositions with impurities

Results

- Activity
- Decay heat
- WDR
 - * Fetter-L and Fetter-H waste disposal ratings for class C waste
 - * NRC (10CFR61) waste disposal ratings for class C and A waste

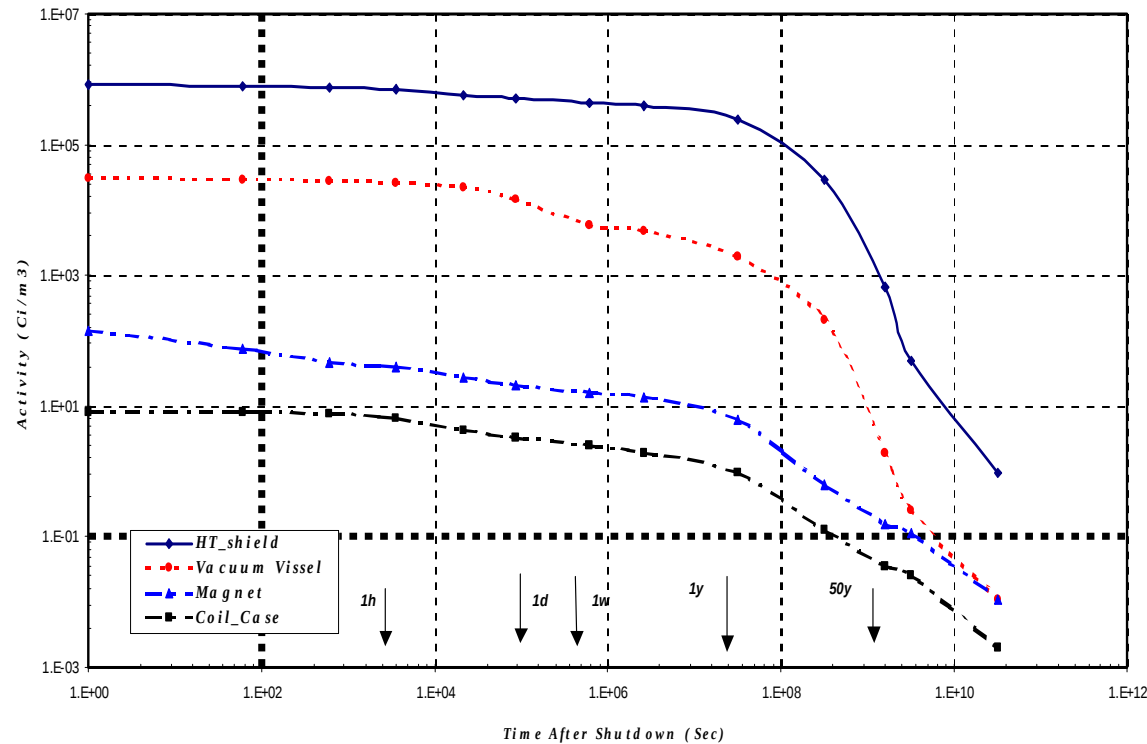


Activity for 4 FPY Components



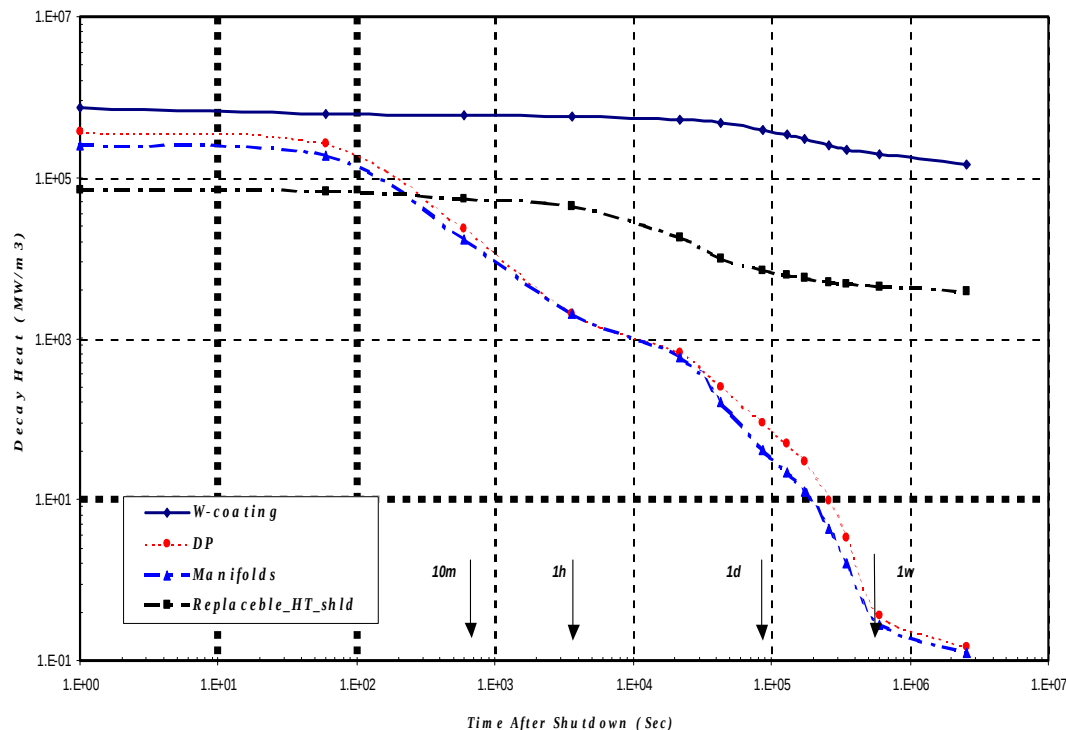
- *Unlike metals SiC activity drops by several orders of magnitude shortly after shutdown*

Activity for 40 FPY Components



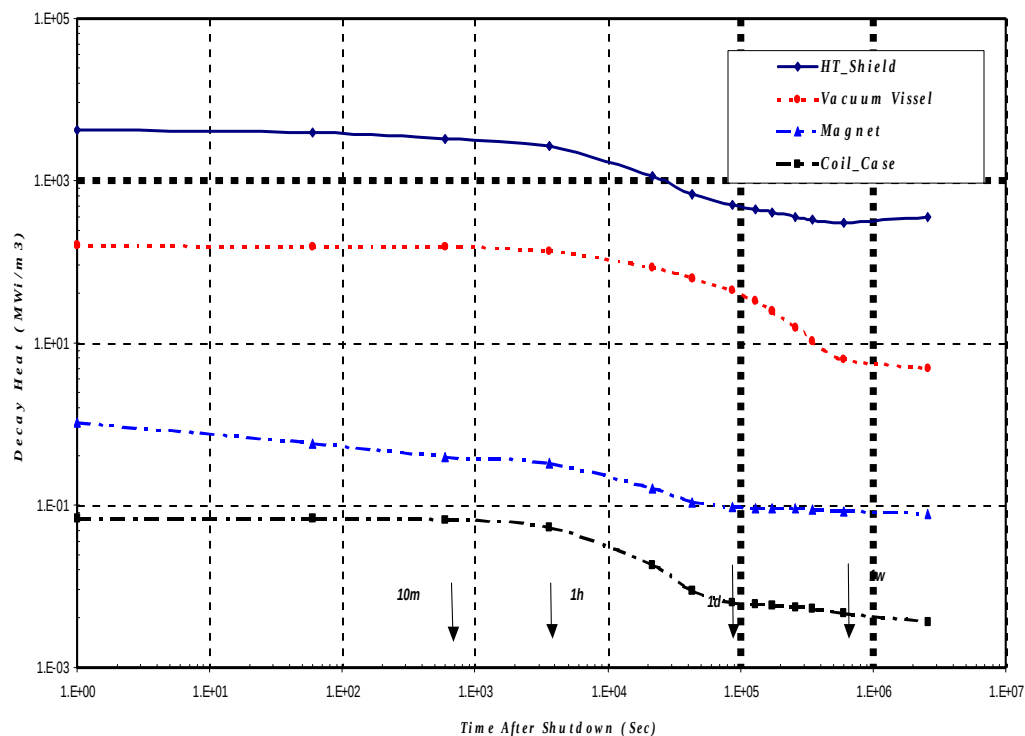
- *High Temperature Shield generates highest activity*

Decay Heat for 4 FPY Components



- *W-Coating has highest decay heat*
- *Unlike metals SiC decay heat drops fast after one minute, meaning slight increase in temperature of SiC components during LOCA/LOFA*

Decay Heat for the 40 FPY Components



Waste Disposal Rating

- ★ *WDR reported for compacted waste*
- ★ *WDR < 1 means component qualifies as low level waste (LLW)*
- ★ *All components should meet both Fetter's and NRC WD limits*



Fetter's WDR Class C

* 4 FPY components

	<u>Fetter-H</u>	<u>Fetter-L</u>
DP with 0.2 cm W	0.1100	0.1300
Manifolds	0.0004	0.0005
Replaceable HT Shield	0.0130	0.0210

* 40 FPY components

HT Shield	0.01800	0.0270
Vacuum Vessel	0.00060	0.0009
Magnet	0.00070	0.0010
Coil Case	0.00007	0.0002



NRC WDR

* 4 FPY components

DP with 0.2 cm W

NRC-A

4.940

NRC-C

0.0003

Manifolds

2.900

0.0010

Replaceable HT Shield

3.000

0.0100

* 40 FPY components

HT Shield

28.000

0.01500

Vacuum Vessel

0.0100

0.00040

Magnet

0.0030

0.00030

Coil Case

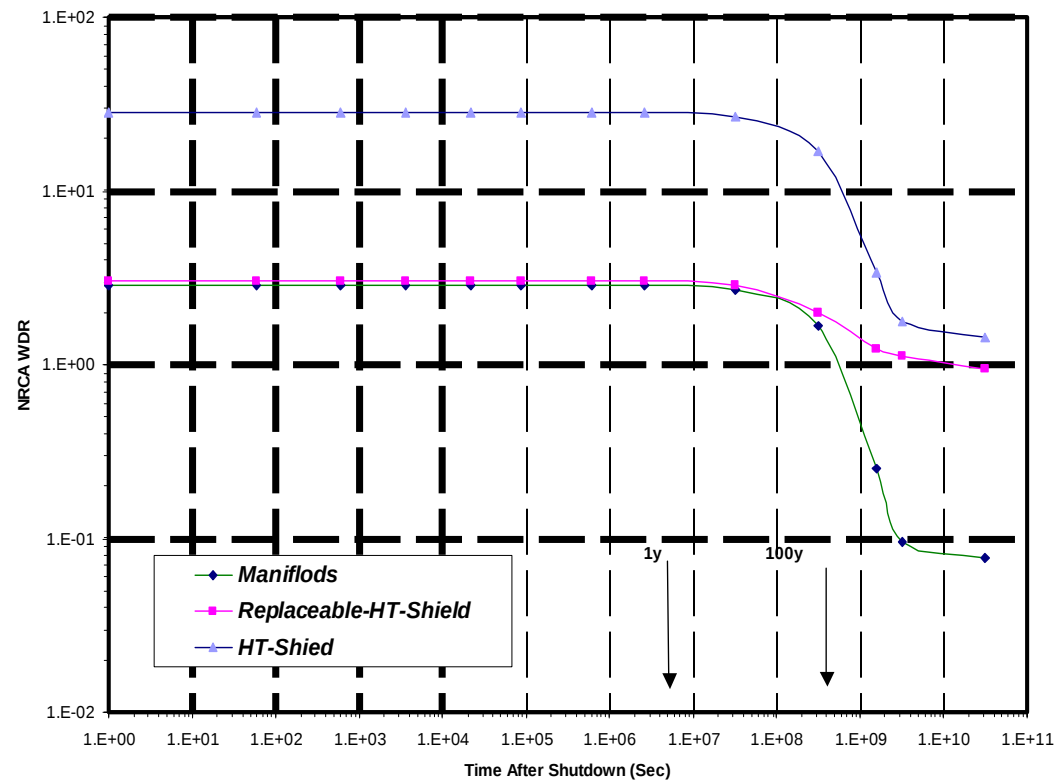
0.0008

0.00006

@ Shutdown



Variation of NRC-A WDR with time after shutdown



Conclusions

★ Activation

- Unlike metal, SiC activity and decay heat drop rapidly by 3 orders of magnitude in one day
- All components qualify easily as Class C LLW
- All components except HT-Shield qualify as Class A LLW after 100 y storage period

