

# The numbers you don't usually look at

Mary Olson

Nuclear Information & Resource Service

August 31, 2010 BRC Subcommittee on  
reactor and fuel cycle technology

# NIRS

- Founded in 1978 by grassroots activists working to stop new nuclear reactors
- Members in all 50 states today
- Disproportionate representation from reactor communities and existing and proposed nuclear waste dump sites
- Petitioned the Secretary of Energy in 1998 to disqualify Yucca Mountain

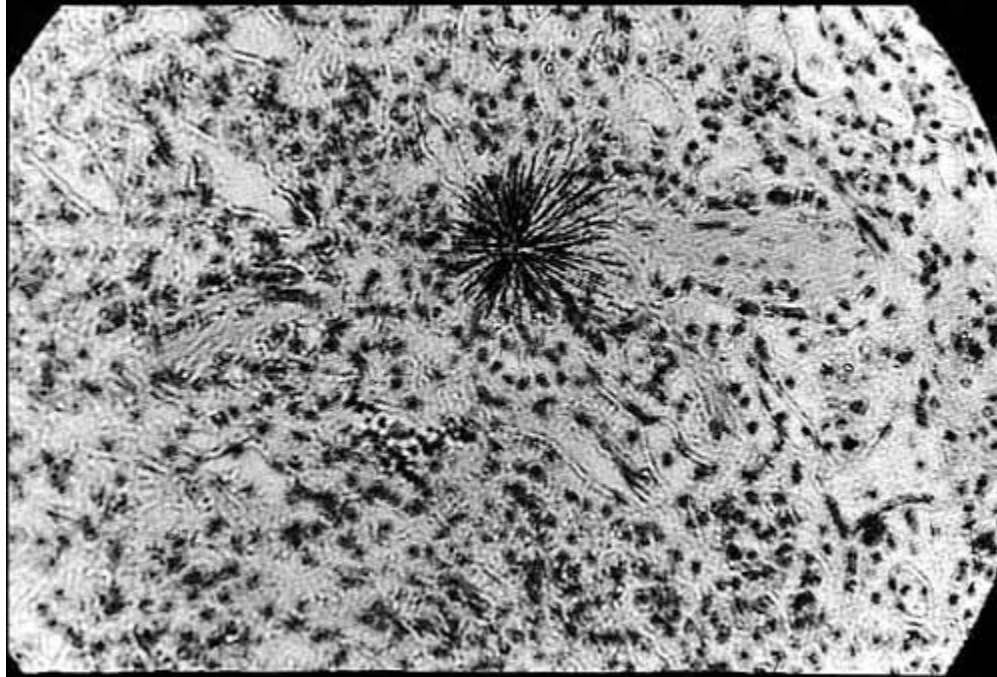
# No Safe Dose of Radiation

- All it takes is a single living cell and a single emission from a radioactive nucleus to start a fatal cancer
  
- Does cancer result from every dose?  
No, but death is possible from a dose so small it is not measurable – or other impacts such as loss of an embryo

# No Safe Dose is not a folk song

- EPA Standards
- NRC part 20 and ALARA
- National Academy of Sciences BEIR VII
- MOST important: data supports

# Visible damage to lung tissue from Plutonium

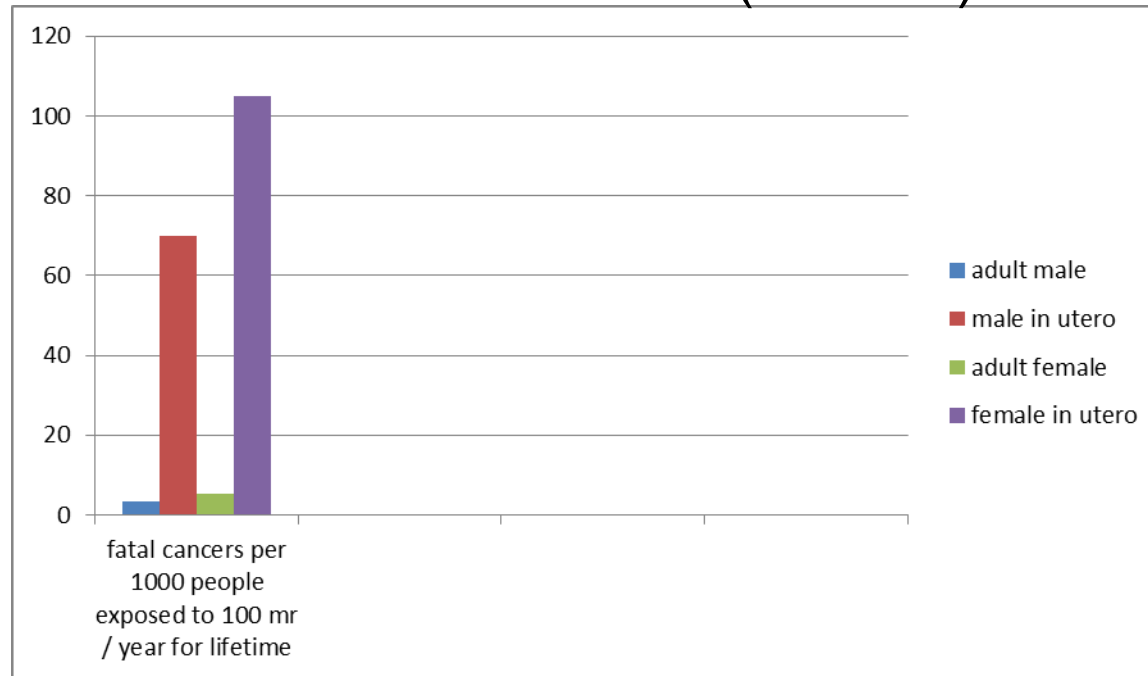


# How many deaths are acceptable?

- 1 in a million?
- Superfund: 1 in 100,000 and in some cases as high as 1 in 10,000
- What level of risk do we “accept” from radiation?

US standards “privilege” radiation compared to other hazards.

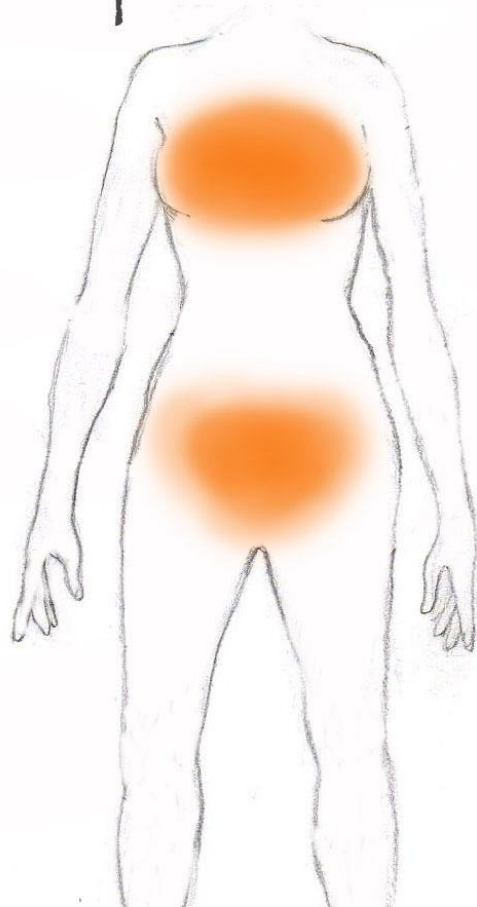
Annual goal of 100 mr “allows” 3.5 fatal cancers / 1000 adult males (lifetime)



Radiation risk published In 1990 -- Nuclear Regulatory Commission in its “Below Regulatory Concern” (BRC) waste policy

(repealed by Congress in 1992).

Females have 50% more  
high-risk tissue  
compared to males





# 3.5 fatal cancers in 1000 men =

- 1 in 286 men
- 1.5 in 286 women (BEIR 3) or
- 1 in 191 women
- 20 in 286 males in utero or 1 in 14.3
- 30 in 286 females in utero or 1 in 9.5

Worker standards= 40 in 286 or 1 in 7  
(male)

For every fatal cancer, there is a non-fatal

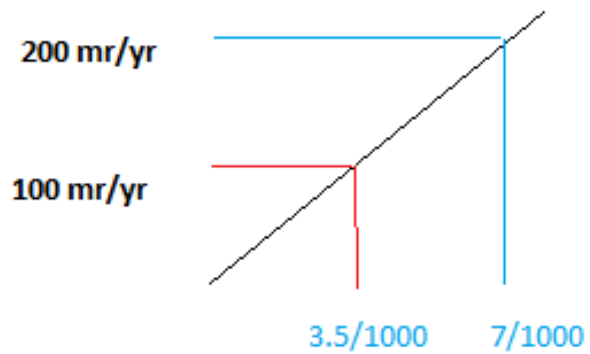
- Applied to the US population (now over 400 million), these numbers are not small
- For every fatal cancer there is a non-fatal cancer
- Damage to embryo may be early and catastrophic resulting in “spontaneous abortion” and other types of infertility

- 100 millirems a year corresponds to recent assessments of “background” radiation
- Allowing radiation doses from industrial operations and wastes constitutes a doubling of both dose and risk.
- Radiation is wrongly “privileged” with an already high “bag limit.”

# Linear No Threshold

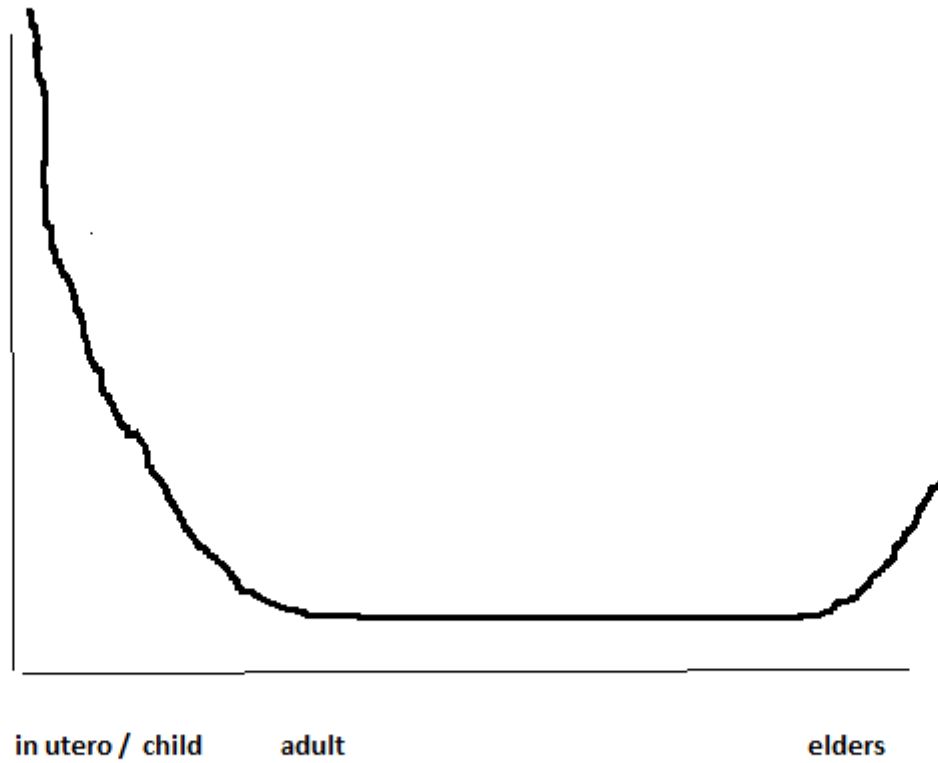
- Many assume this is “overly protective”
- Upheld by the National Academy of Science, US EPA and data in the Department of Energy Low Dose radiation research program
- Independent analysts assert that the NRC numbers are off by a factor of 10 (too low)

**Linear no-threshold assuming adult males -- lifetime dose**

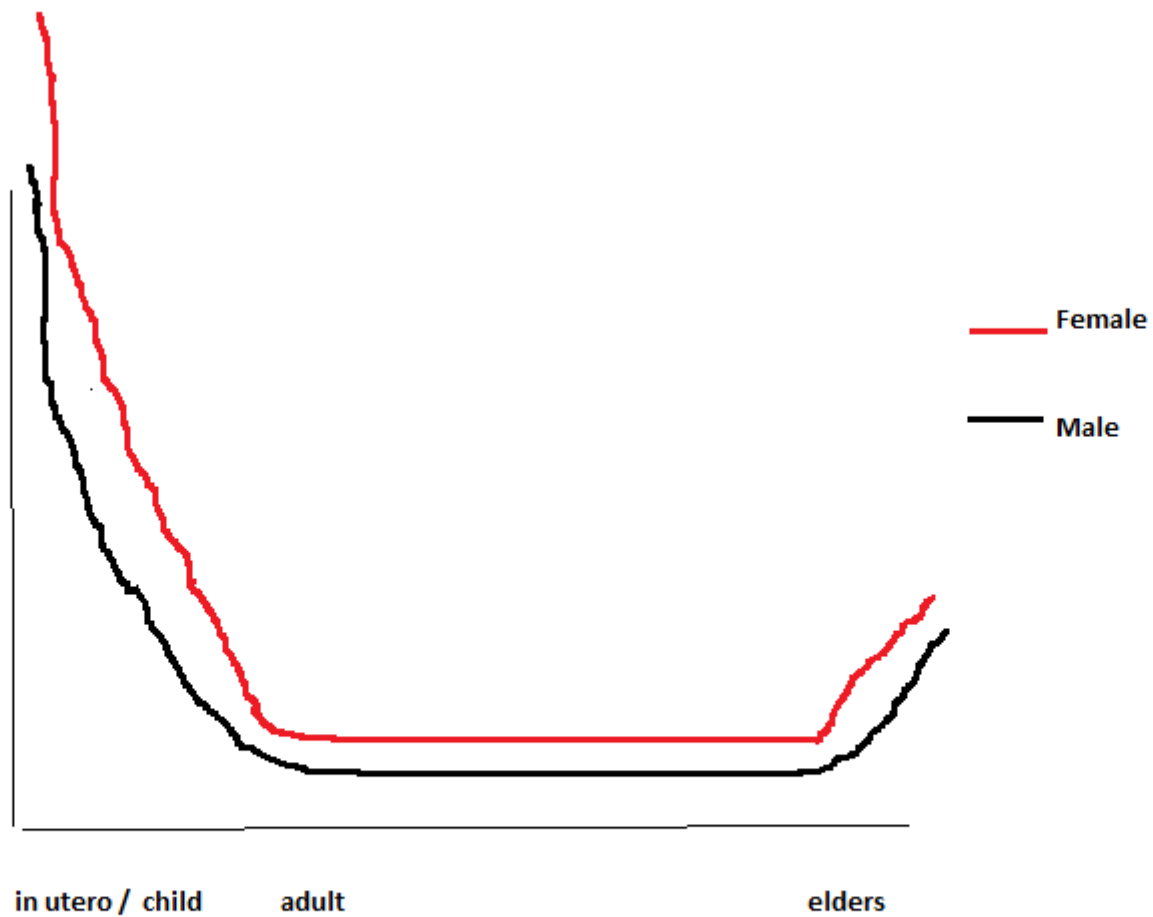


Linear: double the dose, double the response

No threshold: only ZERO is 100% safe



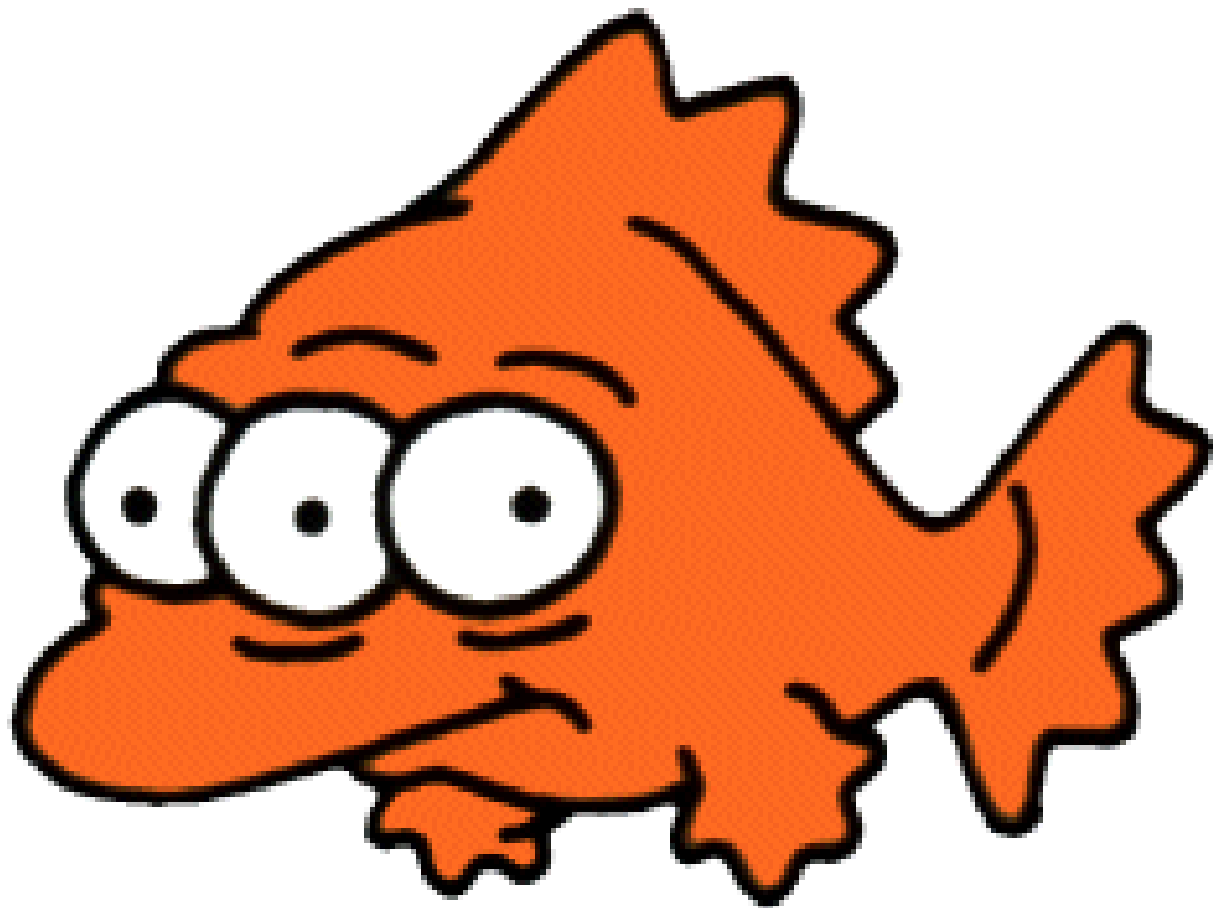
Life-cycle “dose – response” curve to ionizing radiation



Life-cycle “dose – response” curve to ionizing radiation

- Small modular reactors if distributed will also distribute routine radiation releases, and radioactive waste
- When we redefine “baseload” to be the DELIVERY of electric power 24 / 7 instead of generation 24 / 7 we don’t need to take these risks / impost this hazard

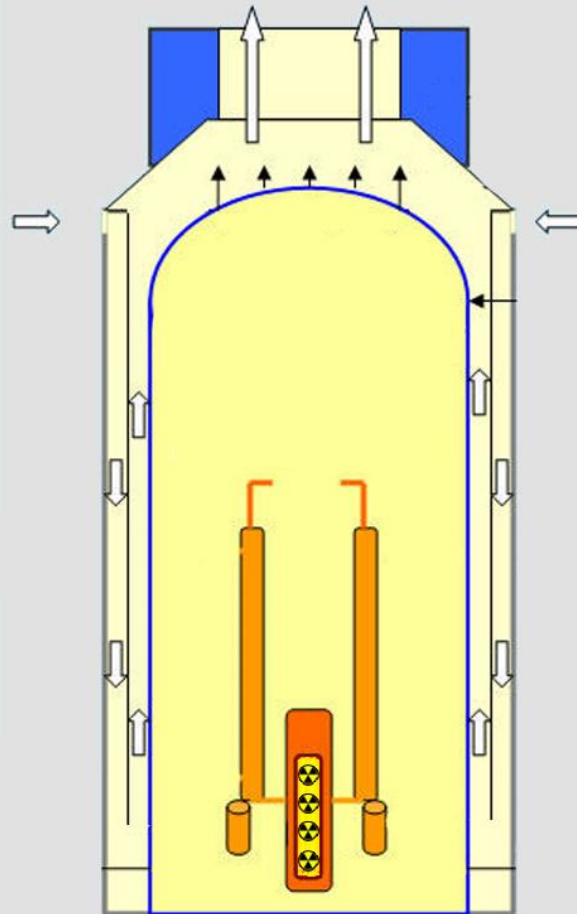




# Plutonium / MOX is worse

- Harder to control in a reactor
- If control is lost – more deadly
- Security
  
- Plutonium is a waste – Midas Touch in Reverse
- Addiction

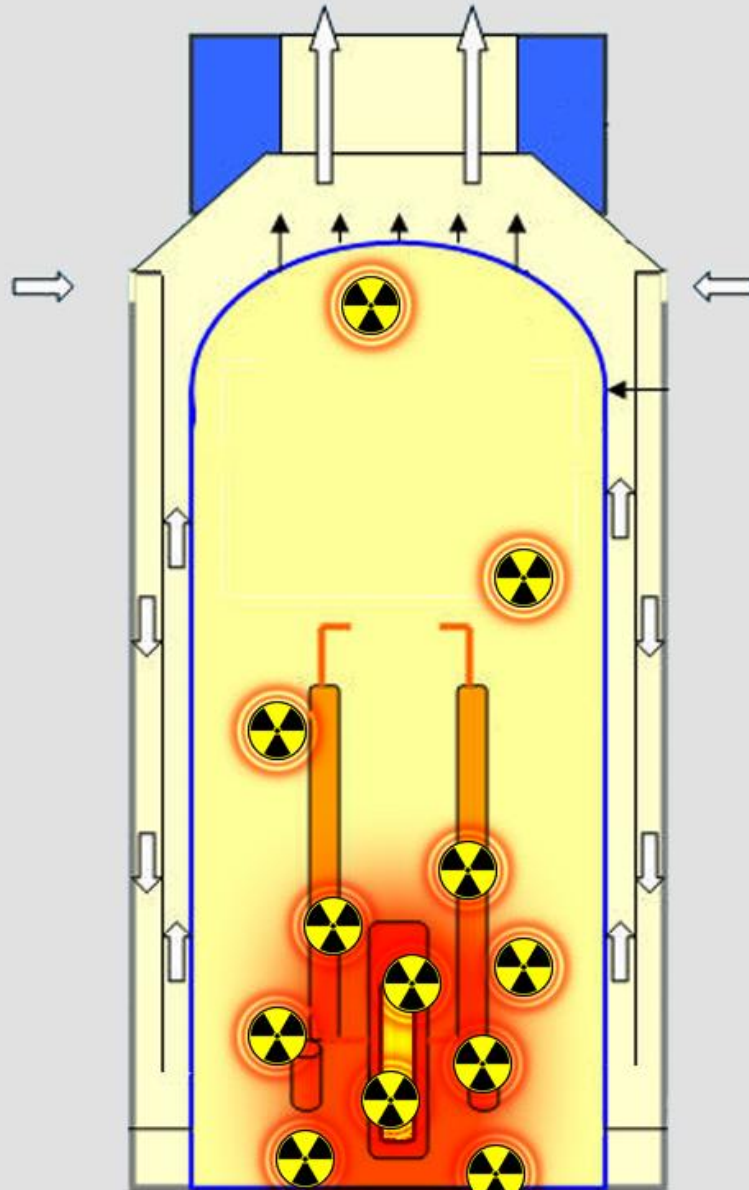
# AP1000 Normal Operation



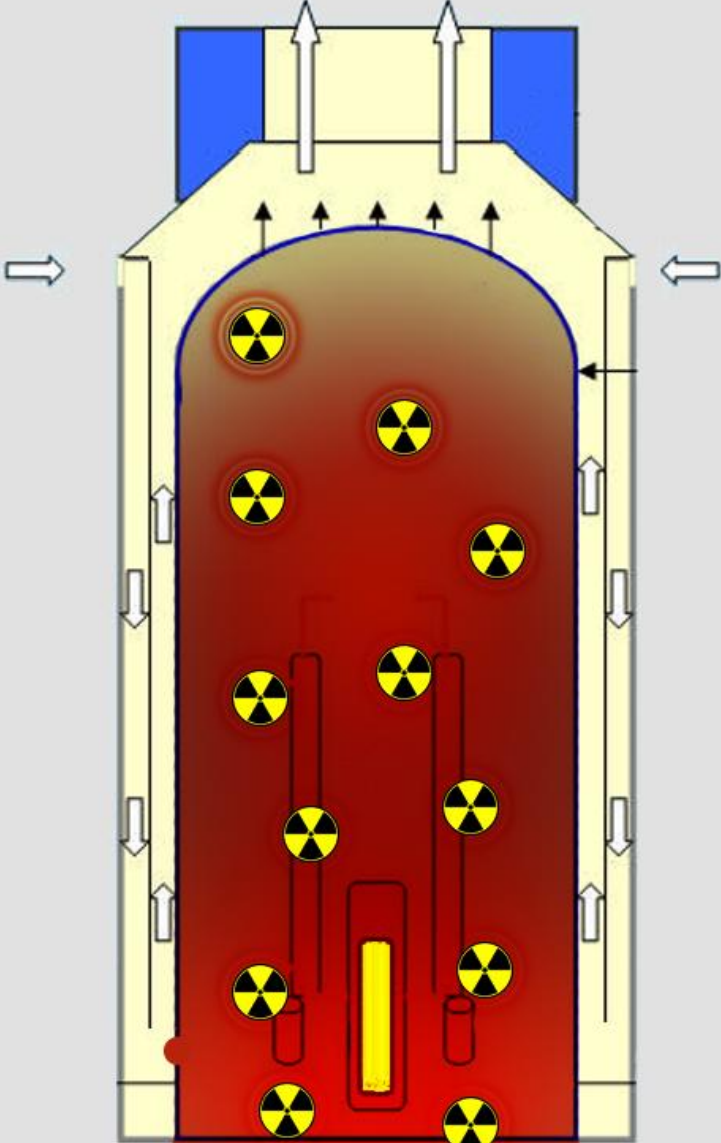
“passively safe”

- Sometimes new  $\neq$  better

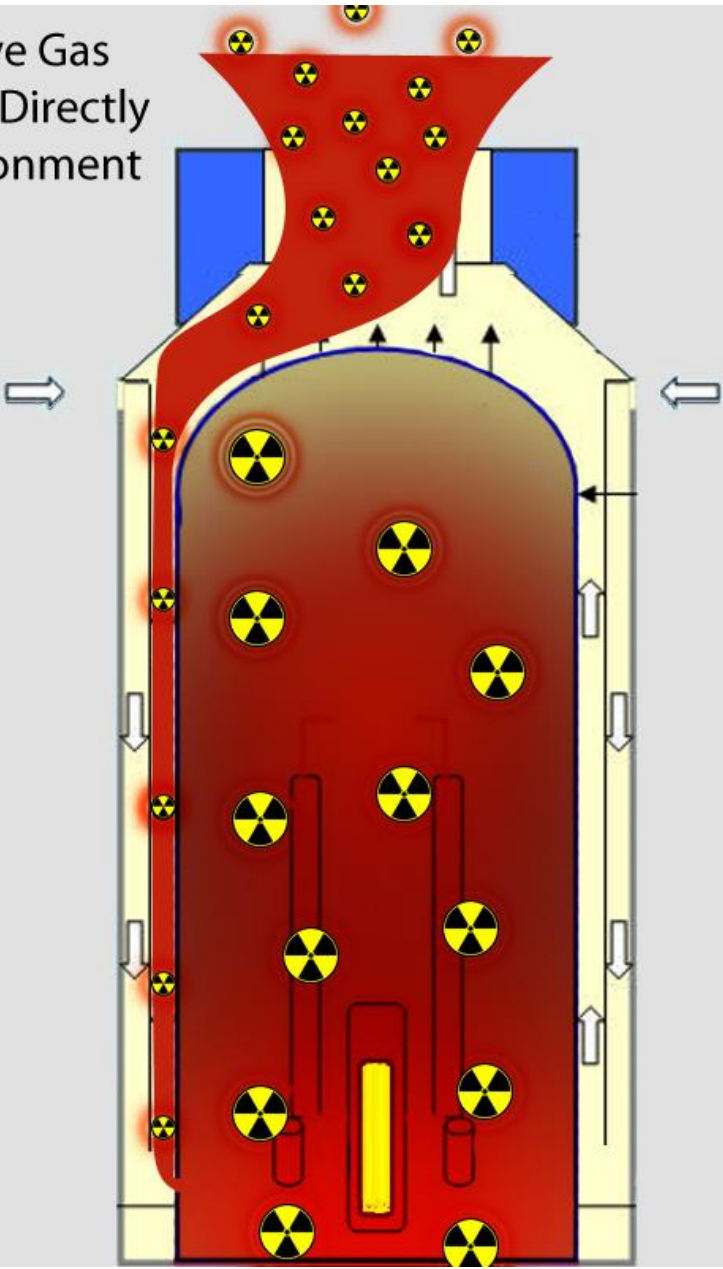
# AP1000 Design Basis Accident Begins



# Containment Fills With Radio Active Gases



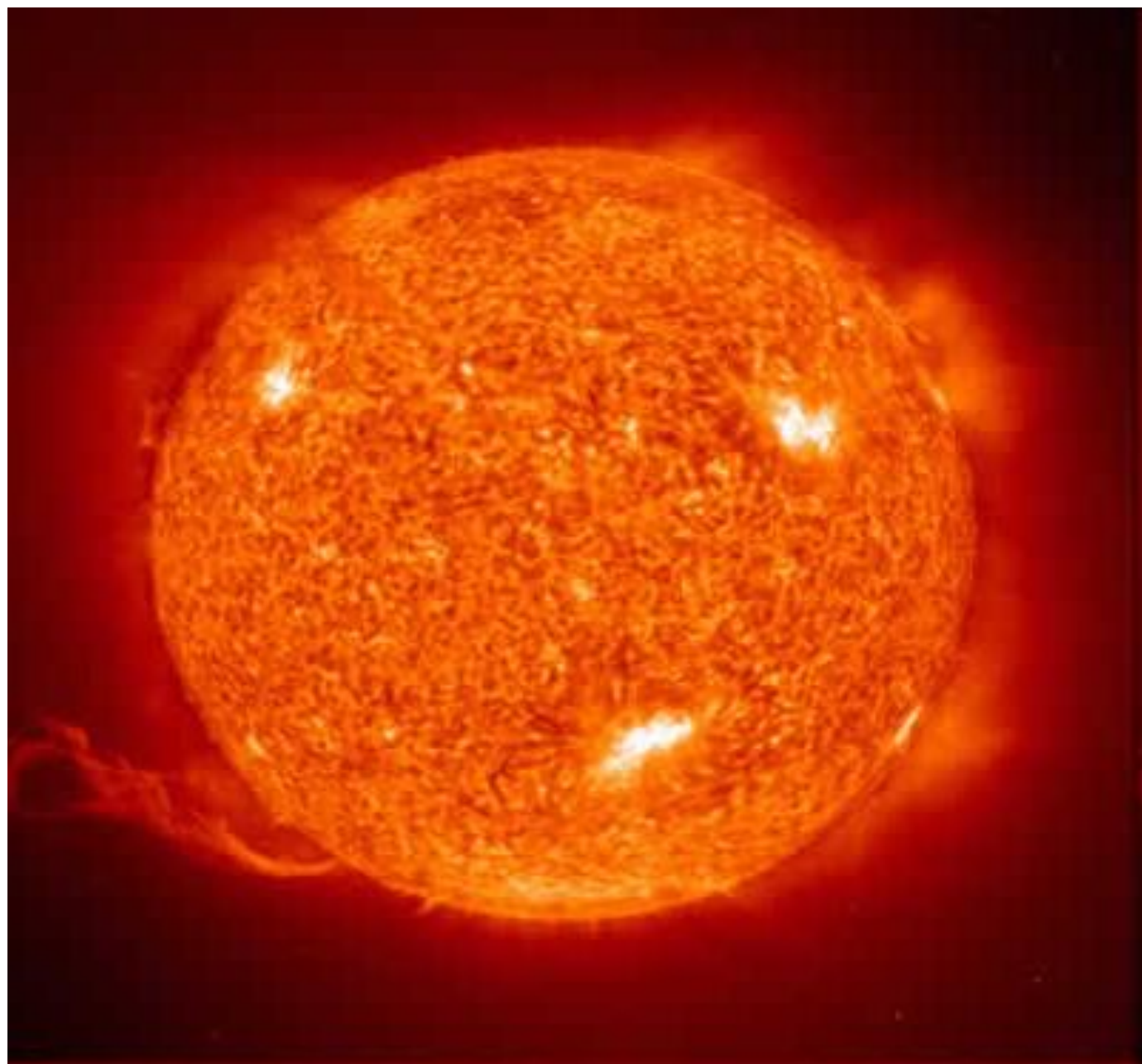
Radioactive Gas  
Siphoned Directly  
Into Environment



# Actively dangerous

- 14 units seeking license of “generic design” – which is not yet fully certified
- Revision 17 of the AP1000 pending
- Somewhat simplified – but does not resolve issues like problems with materials, corrosion, gravity and the 2<sup>nd</sup> law...





# Historic Crossover in PV cost vs New Nuclear Build

