



**International Atomic Energy Agency**

## **P14: Living PSA**

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***Application of Level 1 Probabilistic Safety Assessment***

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# Living PSA

*“A PSA of the plant, which is updated as necessary to reflect the current design and operational features, and is documented in such a way that each aspect of the model can be directly related to existing plant information, plant documentation or the analysts' assumptions in the absence of such information. The LPSA would be used by designers, utility and regulatory personnel for a variety of purposes according to their needs, such as design verification, assessment of potential changes to the plant design or operation, design of training programmes and assessment of changes to the plant licensing basis”*

**IAEA definition** (IAEA-TECDOC-1101, Framework for a Quality Assurance Programme for PSA, 1999)

# Living PSA

- The LPSA meets two basic requirements:
  - 1) PSA is updated if changes are made to plant design and operation, feedback is obtained from internal and external operational experience, the understanding of thermal–hydraulic performance or accident progression is improved, and advances are made in modeling techniques;
  - 2) the PSA model is comprehensively documented so that each aspect of the model is directly related to existing plant information or to the analysts' assumptions of how the plant and the operating staff behave.

# Changes Significant for Living PSA

- **Changes in the design of the plant**
  - changes in types of components
  - safety systems back-fitted to the plant
  - additional protection for severe accidents
- **Changes in the way that the plant is operated**
  - new emergency operating procedures. severe accident management guidelines
- **New data**
  - plant specific data/ generic data
  - component failure probabilities/ initiating event frequencies/ maintenance outages
- **New analysis/ methods**
  - new success criteria for design basis accidents
  - improved methods for modelling common cause failure/ human reliability, etc.

# Updating of Living PSA

- PSA needs to be updated to take account of the changes that are significant to the core damage frequency (CDF) or large release frequency (LRF)
- Frequency of updating needs to be consistent with changes made
- **Minimum period of updating is at Periodic Safety Review (PSR)**
  - Many PSAs updated more frequently than this
- The same QA Procedures used to produce the original PSA should be used to for the Living PSA

# Updating of Living PSA

## ■ New data analysis

- component failure probabilities / failure rates
- initiating event frequencies
- unavailability due to maintenance
- Analysis of trends of data (increase)

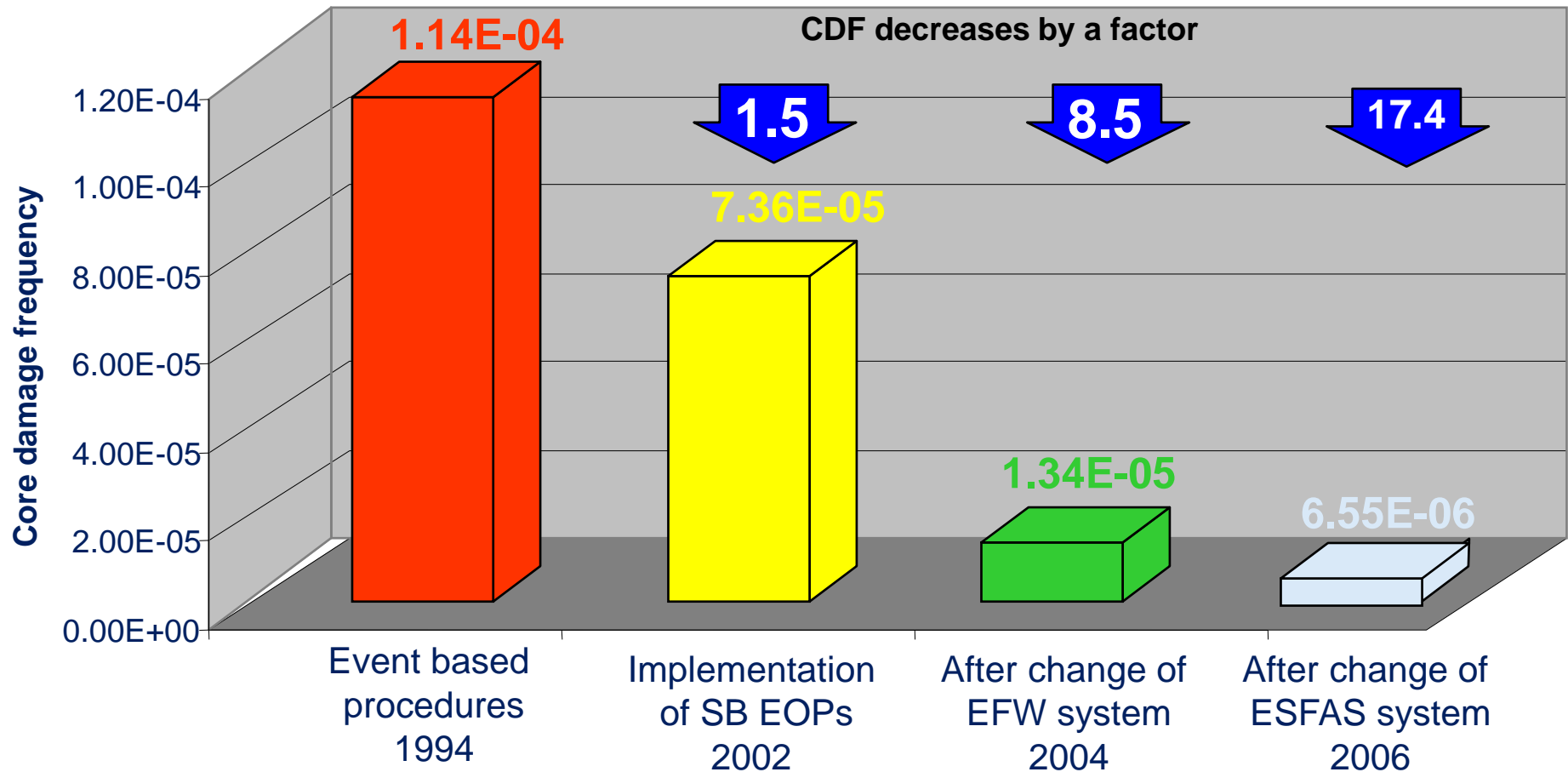
Failure rate	r (2012)	eff		r (2014)	eff
BDA	4,62E-07	2,94		3,81E-07	2,94
BTA	4,41E-07	12,29		3,63E-07	12,29
CAJ	1,23E-05	1,53		1,02E-05	1,53
CBJ	3,53E-05	1,19		3,12E-05	1,19
CDJ	1,59E-06	2,16		1,31E-06	2,16
CEJ	6,94E-06	1,11		6,18E-06	1,12
DGR	9,62E-03	1,40		8,71E-03	1,43
DGS	1,25E-05	1,69		1,03E-05	1,69
DRU	5,51E-07	12,29		4,53E-07	12,29
ECA	6,61E-06	1,55		7,86E-06	1,69
EDA	3,70E-06	1,44		3,62E-06	1,49
ERA	5,87E-06	2,16		4,84E-06	2,16
HXP1	1,57E-07	12,29		1,30E-07	12,29
HXP2	2,20E-07	4,62		1,81E-07	4,62
JTP1	6,79E-07	12,29		5,59E-07	12,29
JTT1	9,44E-07	2,43		7,77E-07	2,43
JTT2	2,29E-07	12,29		1,89E-07	12,29
JTU	5,51E-07	12,29		4,53E-07	12,29
KBC	1,30E-07	12,29		1,07E-07	12,29

# LPSA in Slovakia

## BOHUNICE NPPs Upgrading Program Schedule

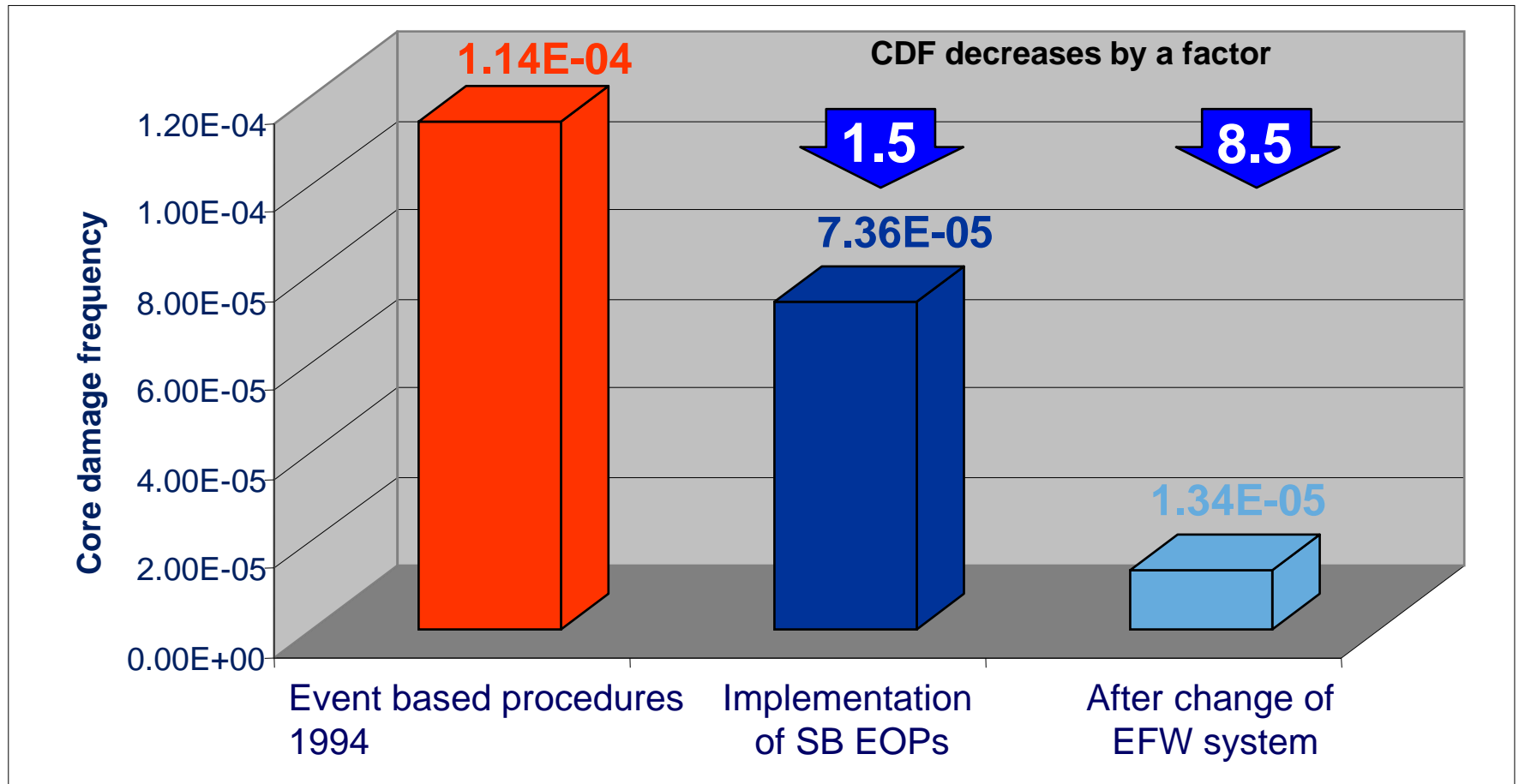


# LPSA in Slovakia – V1 NPP

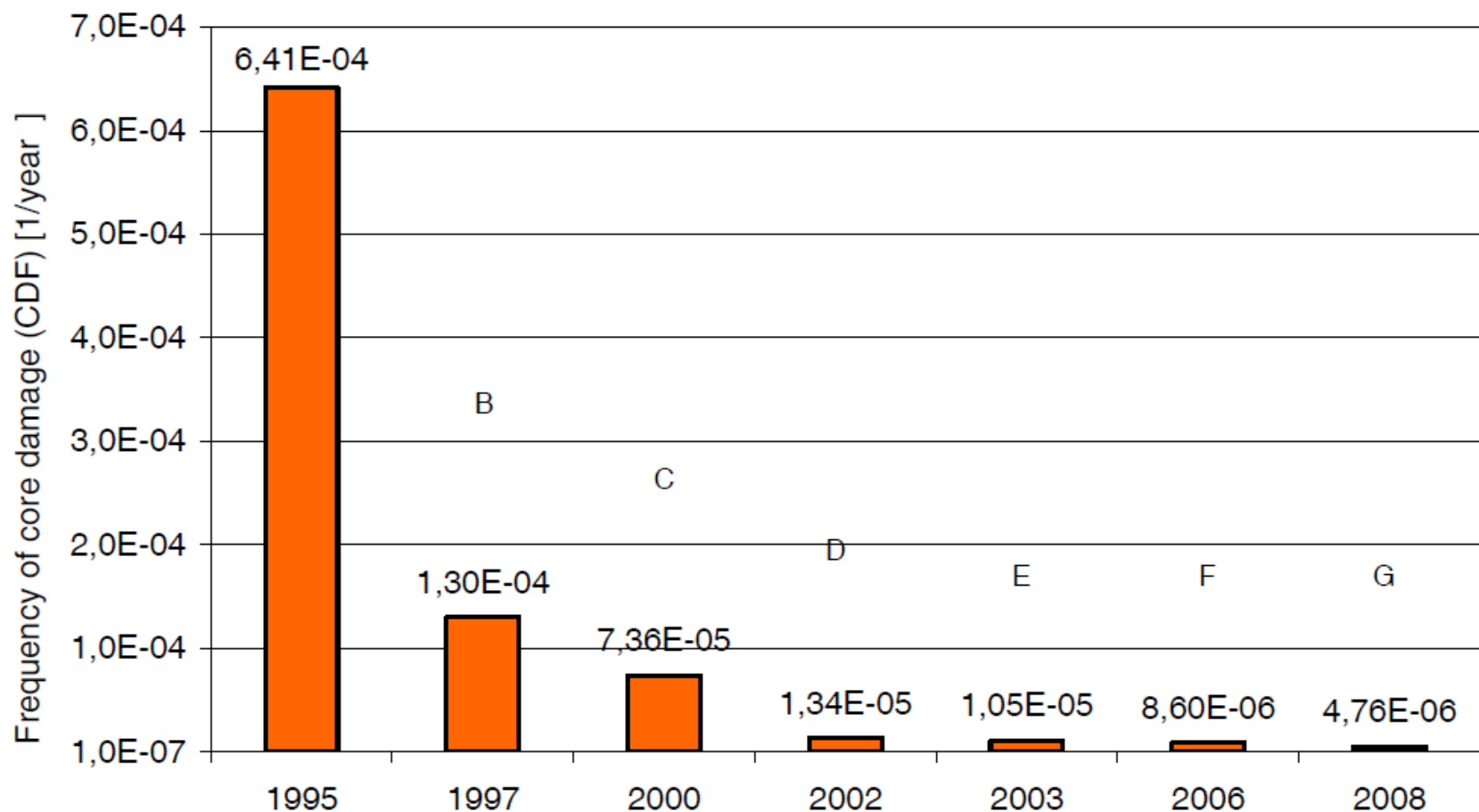




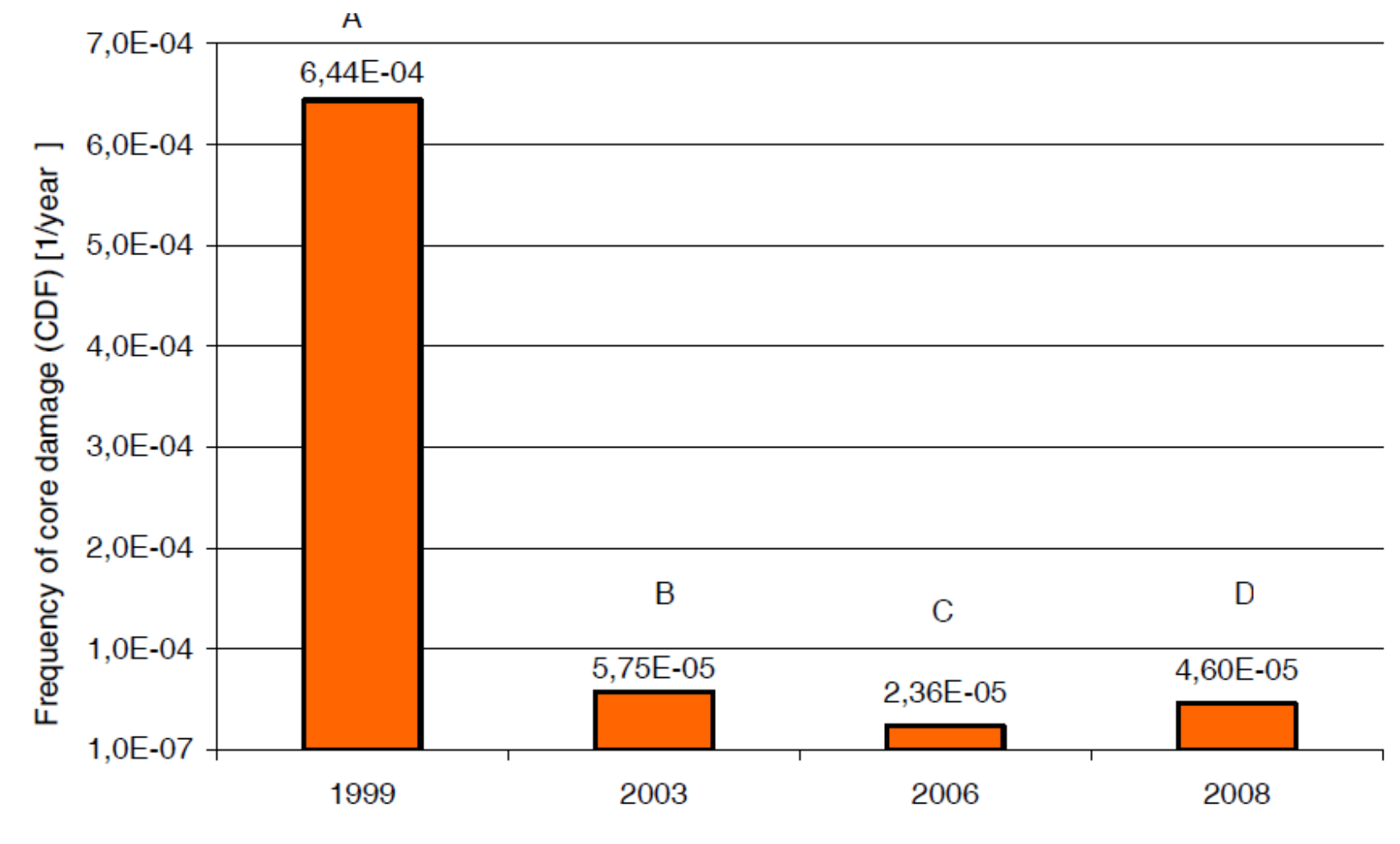
# Plant modifications calculations – V2 NPP



# V2 NPP – summary of level 1 full power PSA results



# V2 NPP – summary of level 1 shutdown PSA results



# Mochovce NPP – summary of level 1 full power and shutdown PSA results

