Preferred partner

«Bruk av risikoanalyser for design: hva bør beholdes og hva bør endres? Synspunkter fra et «engineering» perspektiv.»

ESRA – Norge, Seminar Stavanger 08.03.2017

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Use of risk analysis in development projects

- Topics
  - Experiences from work related to major accident risk for front end studies and the JC – FPSO during Concept and FEED phases
  - Views on opportunities for **suitable risk management** in the oil and gas industry during development projects.

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The Johan Castberg FPSO – To be located in the Barents Sea

Strategy and plan for risk analyses work in JC

The objective is to **optimise** the performance and use of analysis during the concept- , FEED- and EPma phases **to a greater extent** than standard practise in similar projects performed. Key subjects are:

- Initiate analysis only with a **clear purpose** and with a detailing and timing that fits the decision support needed in the project.
- Avoid extensive studies with questionable benefit
- Assure **timely input** of safety requirements and avoid late changes.
- Support the Design Accidental Load specification and Safety Strategy for JC.
- Assure good quality in studies and a good utilisation of study results in the project development.
- Assist design development and optimisation by close **integration** of risk analysis expertise into the project organisation and towards vendors

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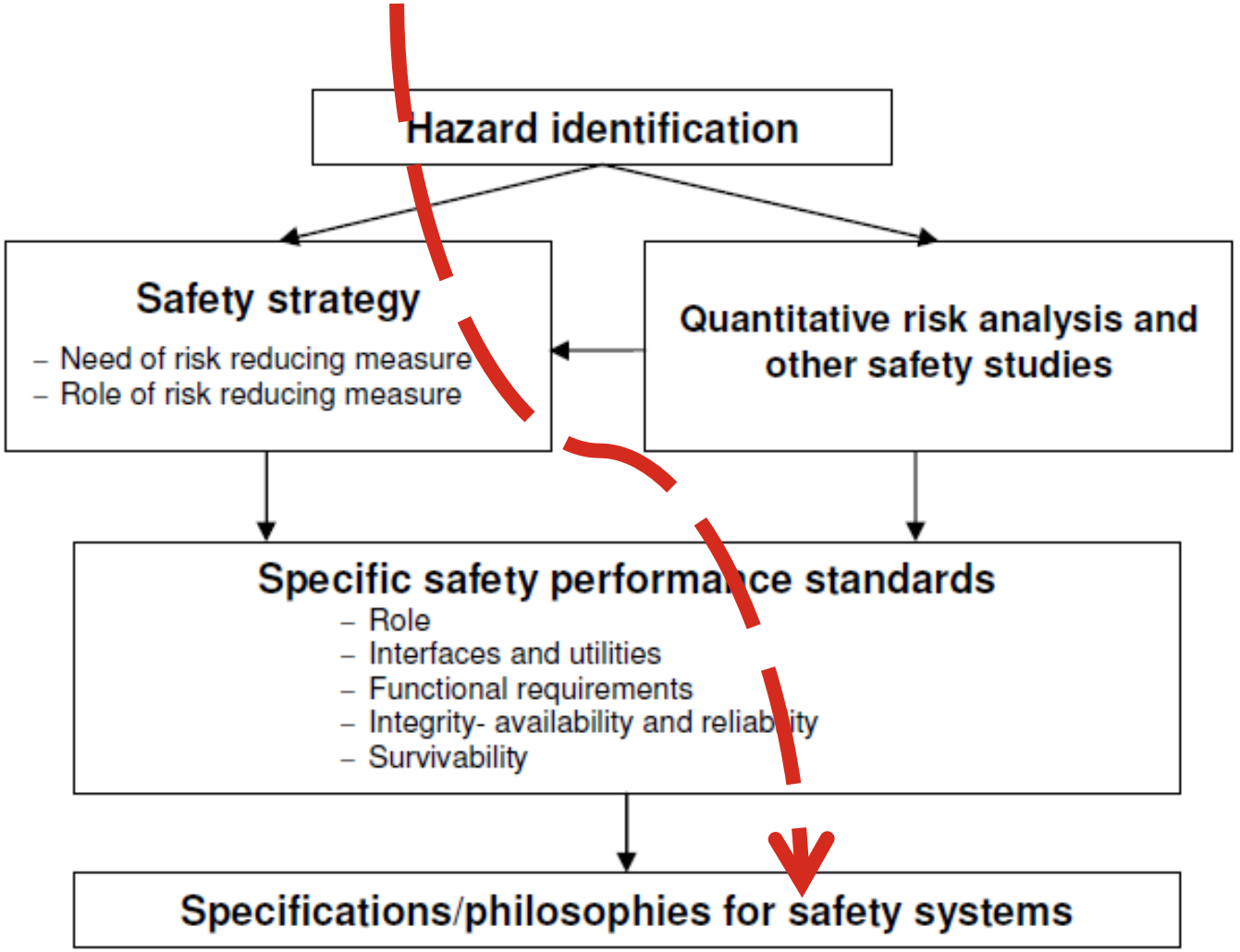
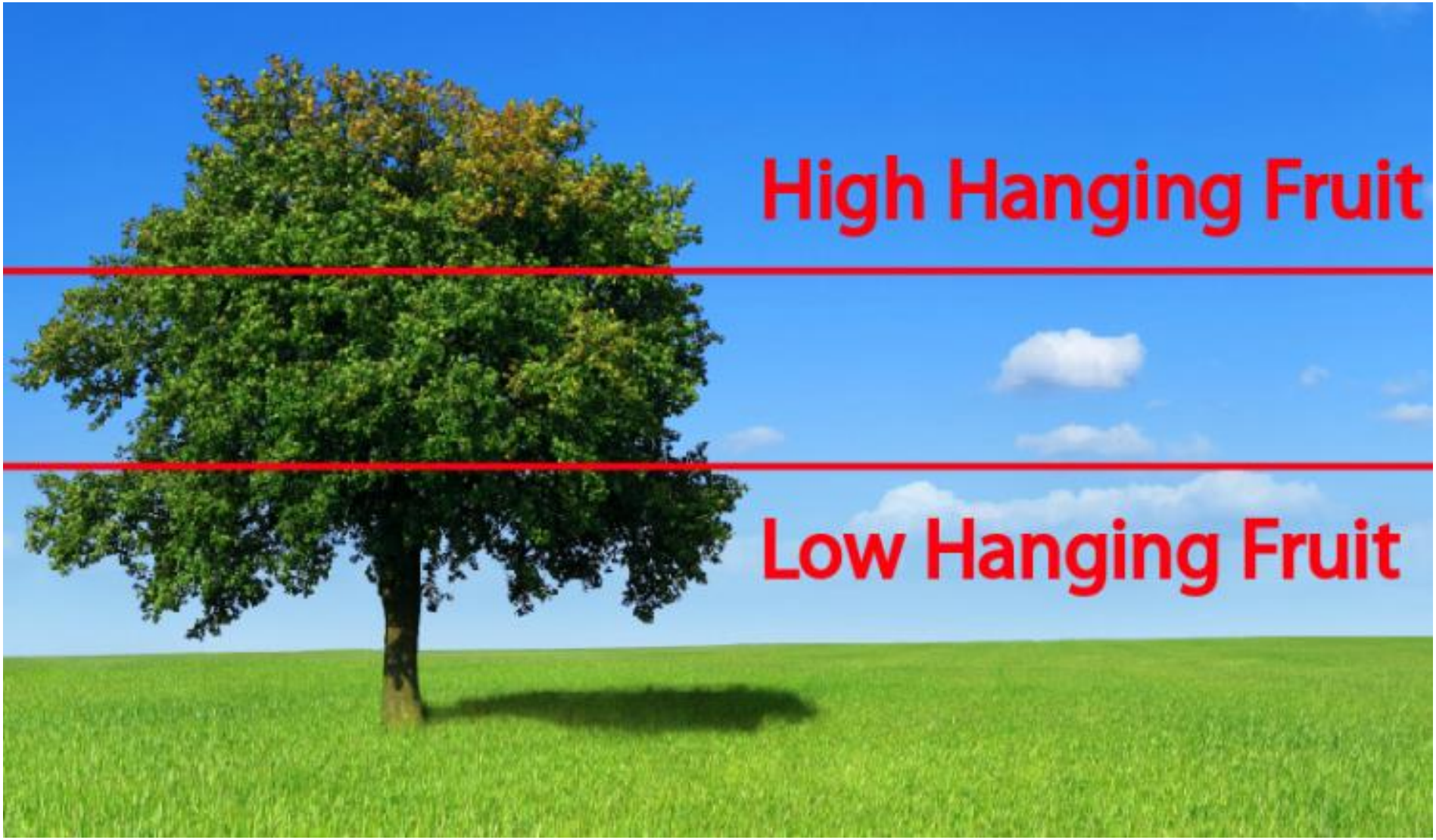
Safety strategy (and DeAL)

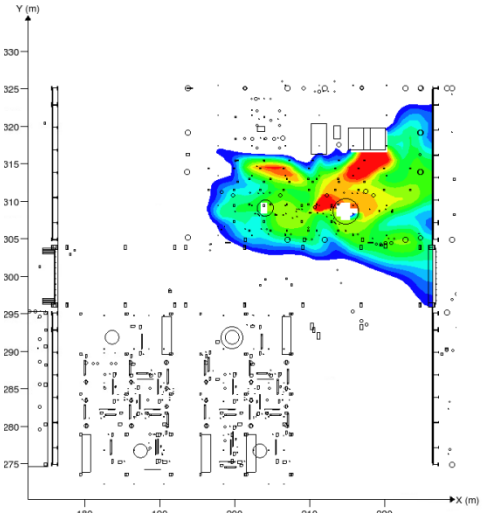


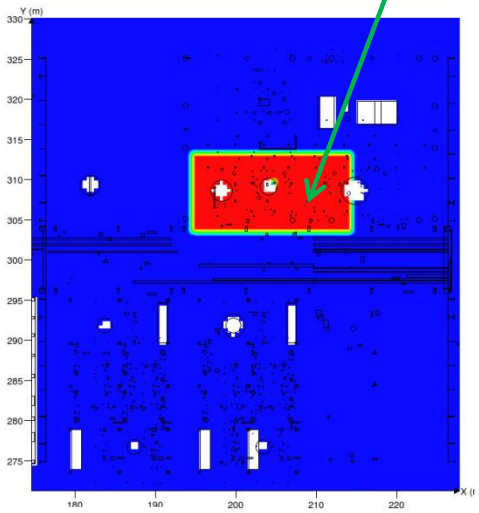

High Hanging Fruit
Low Hanging Fruit

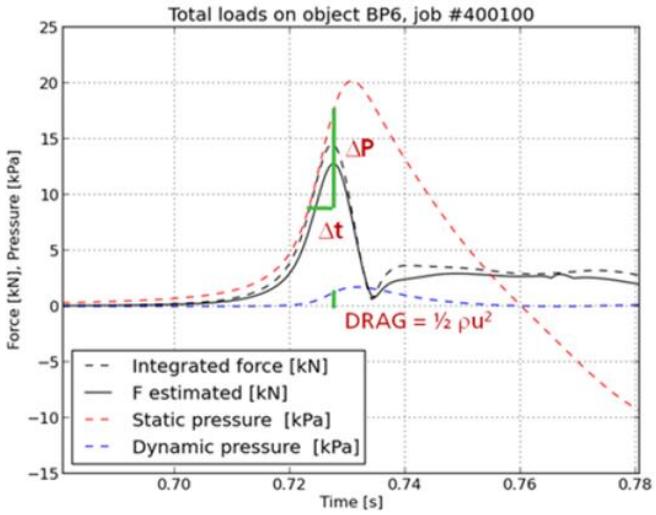
Eksplosjonsanalyser

- *Kunnskap om og praksis for implementering av eksplosjonslaster er svært varierende. Noen steder blir det reflektert svært konservativt og andre steder svært mangelfullt. Enklere regler for implementering jevner ut og gir totalt en bedre sikkerhet (påstand)*

Sample: Design explosion scenarios







Sample: Design explosion scenarios

Area	Hole size/pressure	Leak rate	Cloud size (Q9)	Design pressure requirement
Process aft	40 mm @ 60 barg	6 kg/s	1000-1500 m3	90 % ($+\Delta P_o$ = 0,7 - 1,0; ΔP_d = 0,25)
Process forward	50 – 70 mm @ 14 barg	2-6 kg/s	500-1000 m3	90 % ($+\Delta P_o$ = 0,7 - 1,0; ΔP_d = 0,25)
Turret	25 mm @ 70 barg	3 kg/s	1000 m3	90 % ($+\Delta P_o$ = 0,7 ; ΔP_d = 0,25)
Cargo Deck	200mm @ 0.11 barg	3 – 4 kg/s	1000 m3	90 % ($+\Delta P_o$ = 0,7 ; ΔP_d = 0,25)

Study	Suitable ?	Comments

Hazid	Yes	• Important scope
		• High standing
		• Effective arena
		• Need for repetition due to:
		  • Quality
		  • New people
		• Suitable as 3rd party study

CRA	Yes/?	• Effective to present/transfer experience • Suitable as integrated work, method to establish design requirements, basis for DeAL, safety strategy and recommendations • Weak in probabilistic accuracy and consistency • Data dossier needs high focus (basis for relevant hazard or not)
Emergency preparedness analysis	No	• Limited effect on early design
Operational barriers and safety critical tasks analysis.	?	Important subjects but struggles to find working method to influence design in an effective manner (too theoretical approach?)
SIL / performance requirements	?	• Should have clear focus on major accidents • Less focus on the Machinery Directive, environment and asset protection • Based on standard requirements. Risk based approach only in case of deviation from standard design • Potential for significantly improved efficiency

Subject	Suitable?	Comments

DeAL	Yes	• Based on:
		  • Risk assessment
		  • Minimum requirements
		  • Required robustness
		  • Uncertainty in models and design development
		  • Cost of measures
		• Decision document – to be established by engineering
		• Basis for risk assessment
		• Need input and improvement from CRA /DRA

Safety Strategy	Yes	• Scope under development • (Hazard register) • Description of priorities and strategies
Bow – tie diagram	Yes	• Simple but effective in improving risk understanding
Integrated risk assessment work	Yes	• Very effective
Risk management	?	• Challenging • ALARP good in theory – but not in practice • Methods / practice should be improved

Other improvement topics related to risk assessment

- **Risk consultants**:
  - More focus on use of the analysis. Less focus on the ultimate calculation.
- **Engineering**: Improved description of SoW and needs.
- **PSA**: Limit unreasonable expectations to link between high level functional risk requirements and design solutions. Contribute to closing the gap.
- **Operators**: Too much focus on repeated detailed calculation on well known aspects. Need more focus on purpose and value.
- **All:**
  - Too much focus on transfer of responsibility to others (limitation of liability)?
  - Too complex analysis. Only the best ones has sufficient quality.
  - Improve data dossiers for major accidents. Assure traceability and description of concrete accidents as basis for selection of relevant events to consider.

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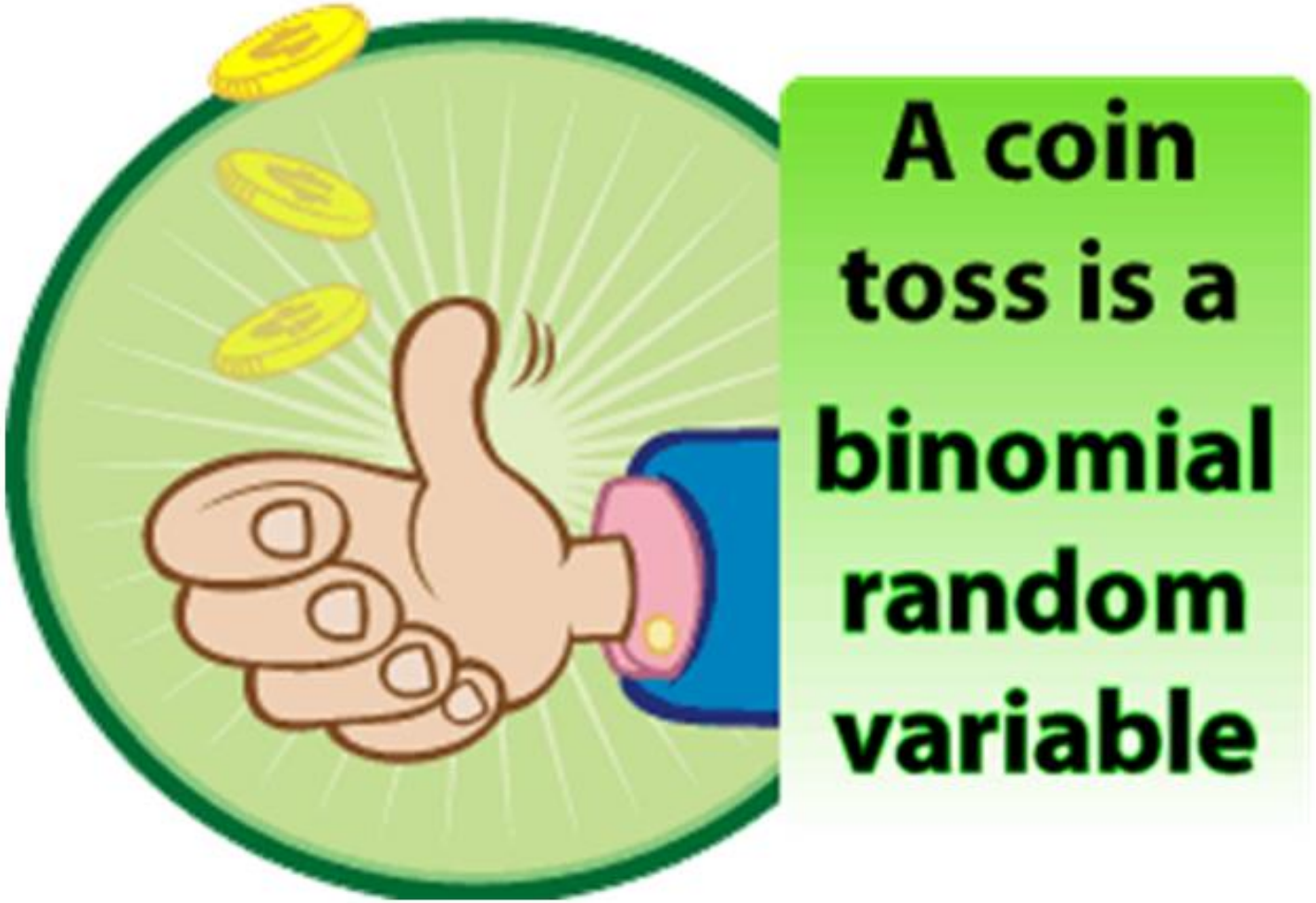
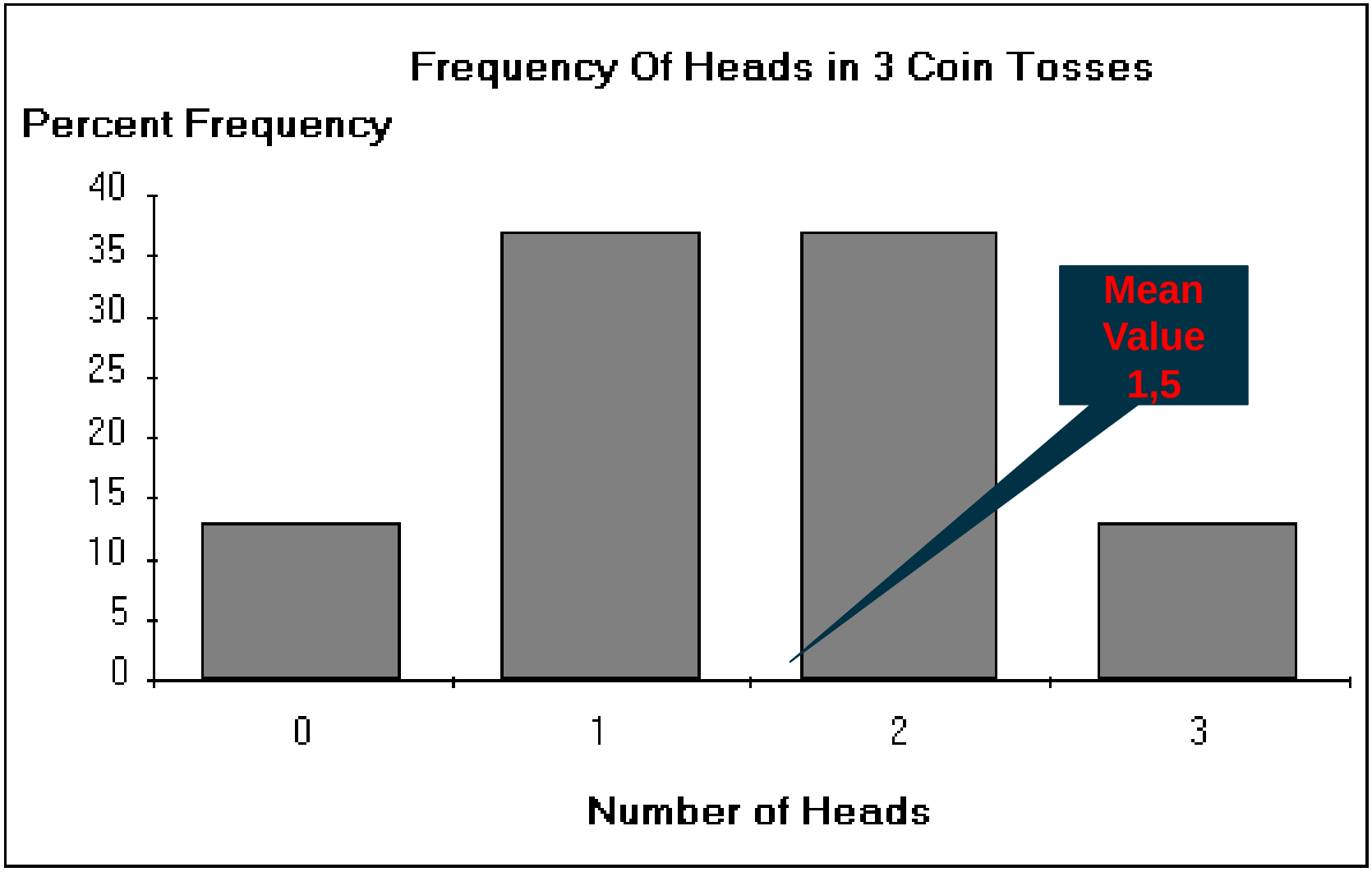
Objectives for risk assessment process according to Z-1013

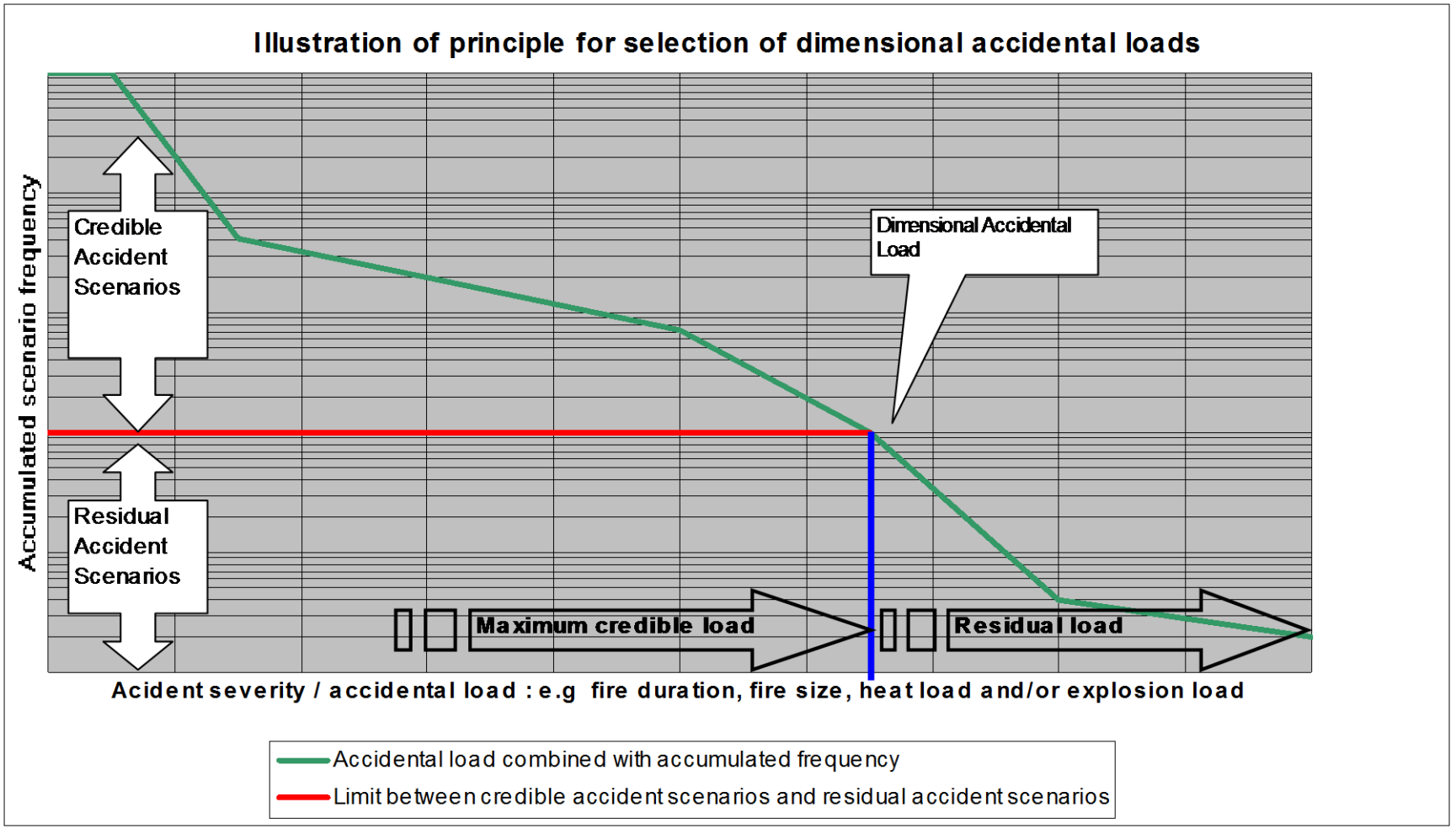
a) suitable with respect to its intended objectives and purpose,
b) executed with a suitable scope and level of quality,
c) tailored to the facility, system(s), operations, etc. of interest,
d) tailored to the required and available level of detail.


A coin
toss is a
binomial
random
variable


Frequency Of Heads in 3 Coin Tosses
Percent Frequency
40
35
30
25
20
15
10
5
0
0
1
2
3
Number of Heads
Mean Value 1,5

From Plofam TN-6 Conclusions:

The strategy has been to build a model that gives a best estimate for future leak frequencies, i.e. to create an unbiased model without built in conservatism. It is observed a significant decreasing trend in historical leak frequency with time for installations on the NCS in the period after year 2000. The period 2001-2014 is used as basis for the model, but the historical frequency for all installations on NCS the last 5 year period is 40% less than the average for the period 2001-2014. Hence, presuming that the number of leaks at the NCS in the future will follow the observed frequency for the last 5 year period, PLOFAM is regarded to give robust results for future average leak frequencies for installations on the NCS. The period 2001-2014 is used as basis for the model to account for uncertainty in the data material and shifts in underlying casual factors (e.g. emerging unknown degradation mechanisms due to age or changing operational conditions) affecting the future trend in leaks occurring on installations on the NCS.
It should be mentioned that the historical leak frequency per installation at the NCS can vary significantly from the NCS average, as a result of stochastic effects.



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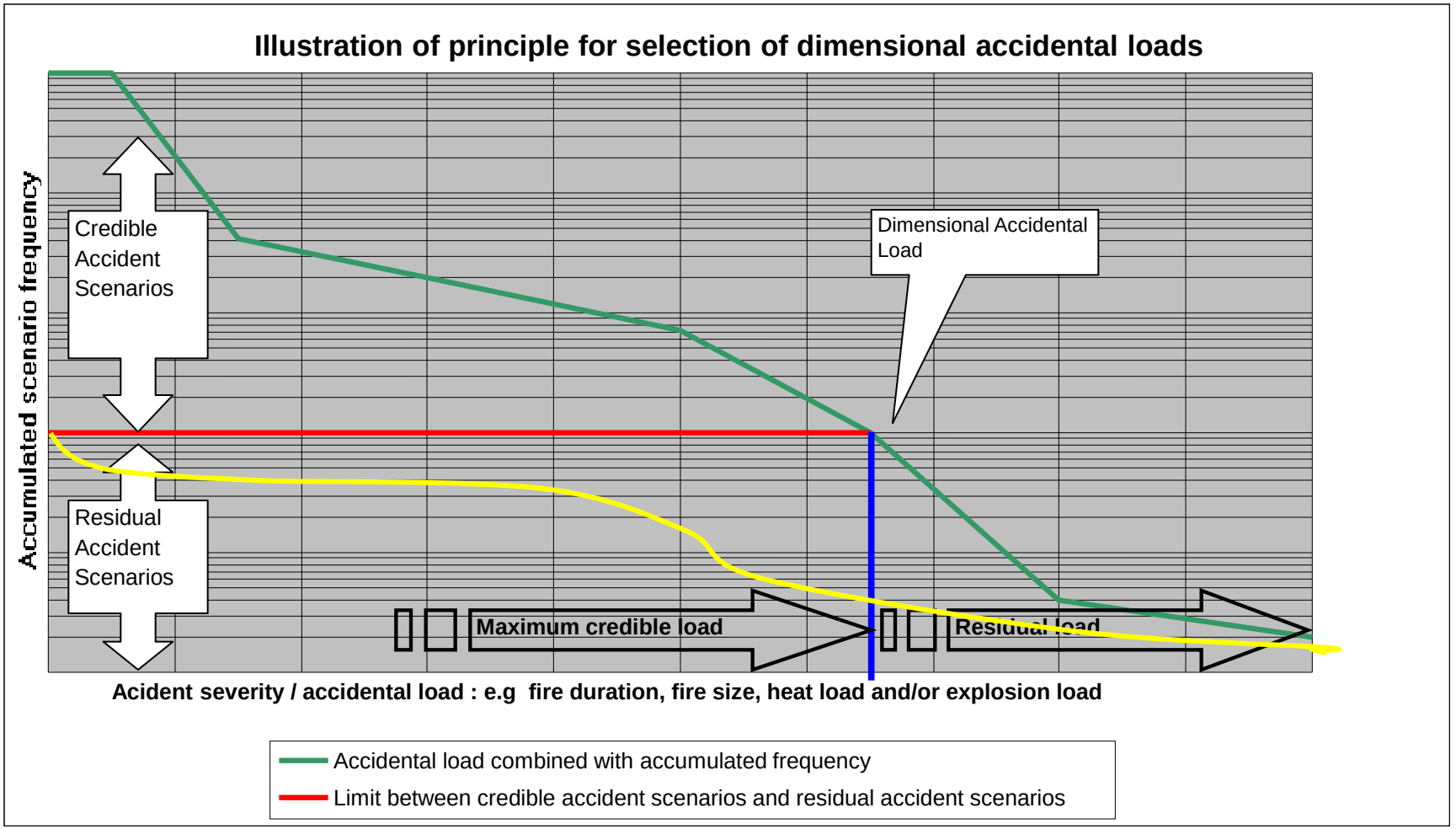


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