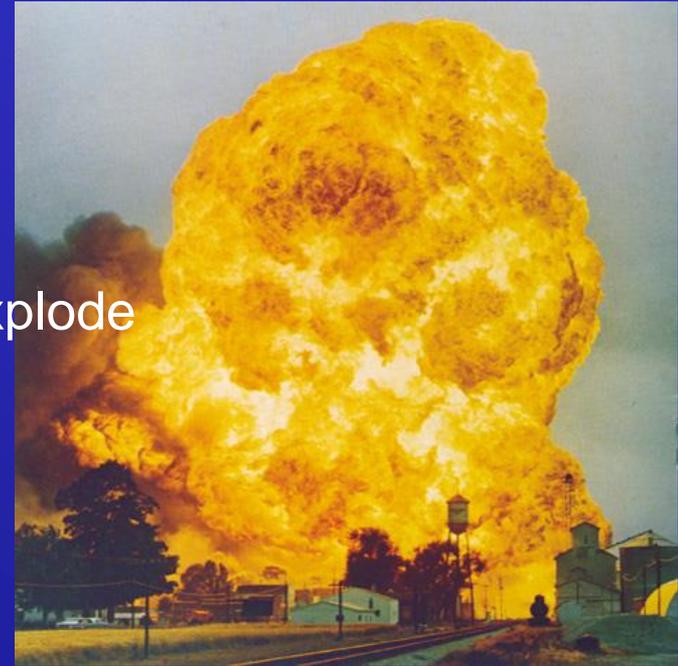


The case of 10^{-6}

and other alternative opinions:
from judgement to opinion

Risk analysis

- What is risk
 - Popular opinion: sum of $p \cdot c$ (even among experts)
- Need
 - Consequence modelling
 - Failure frequencies
- Especially
 - Pressure vessels
 - They had the tendency to violently explode



Current value

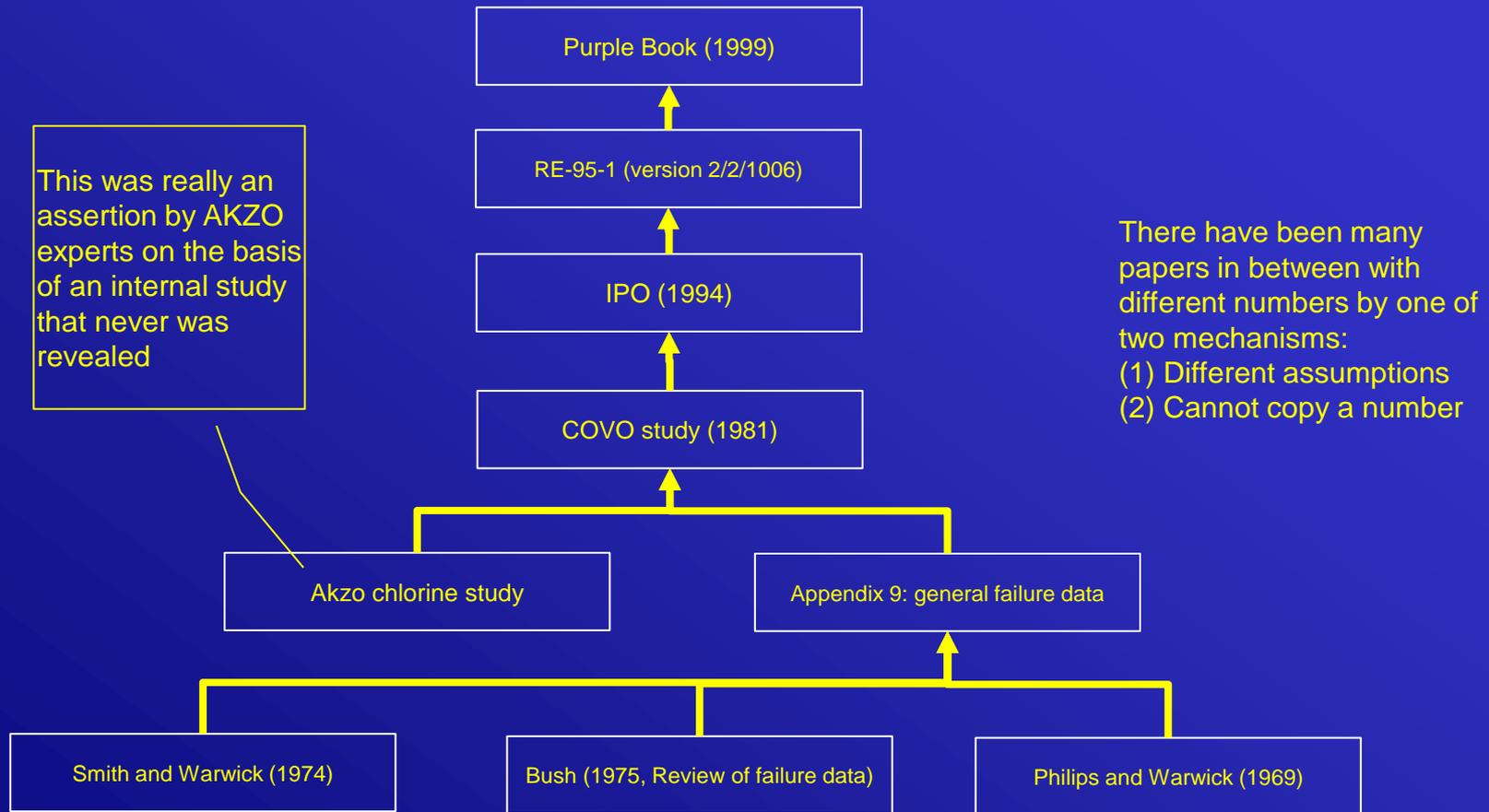
Instantaneous release	Continuous release in 10 min	Continuous release 10 mm hole
.5 e-6	.5 e-6	10 e-6

“The failure frequencies given here are default failure frequencies based on the situation that corrosion, fatigue due to vibrations, operating errors and external impacts are excluded.”

The same caution was given in the COVO study

This caution usually is forgotten

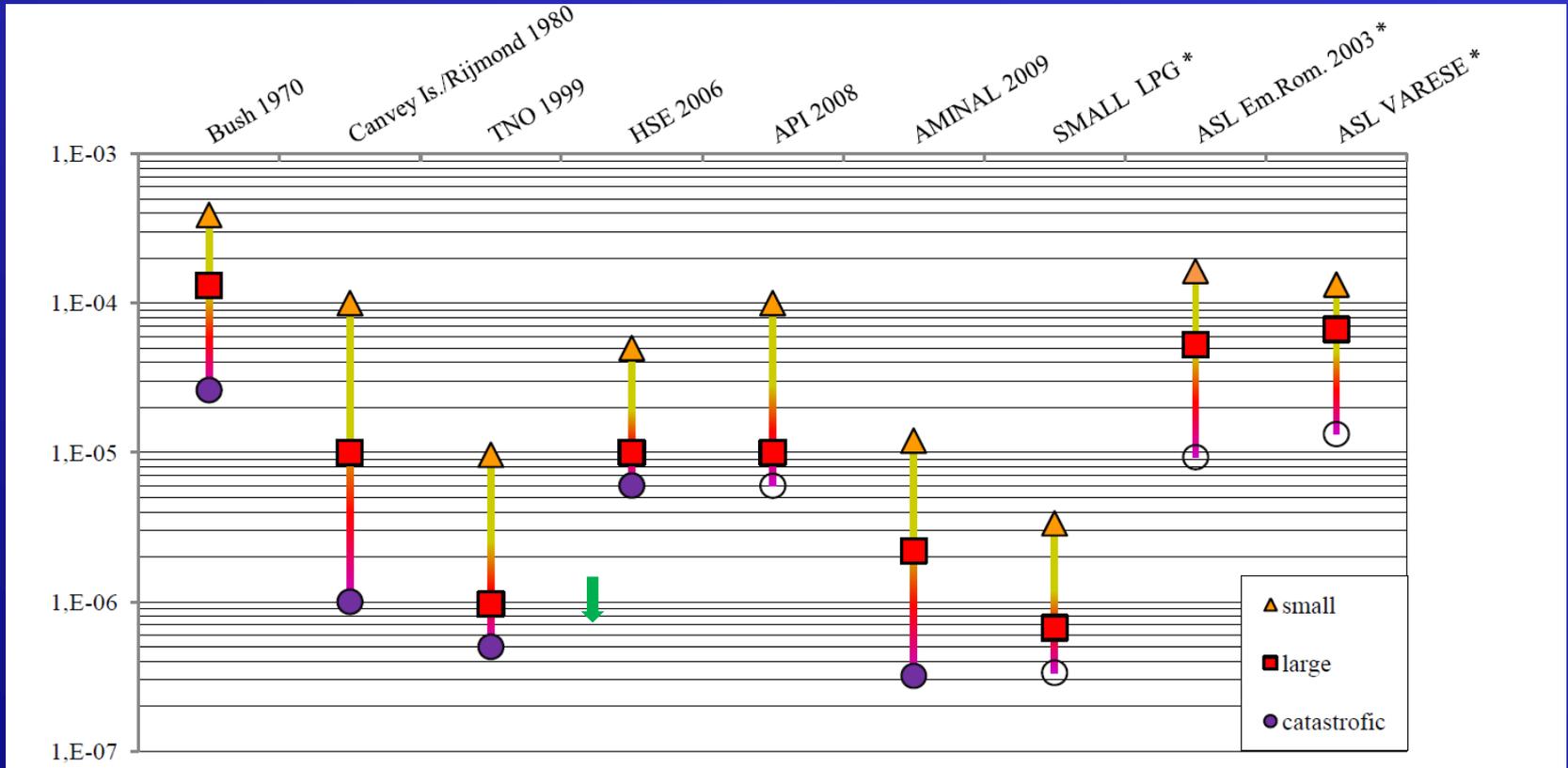
Where did it originate



Notably Nussey (2006)

- HSE uses 2.0×10^{-6} and keep on doing that
 - But they had 1×10^{-5} earlier
- Because they do not accept that a company can meet the conditions under which 1×10^{-6} would be the number
- They announce a study to get better statistics and better numbers
- In fact in 2012 a concept project description was issued.
 - Together with RIVM.

Data?



So far

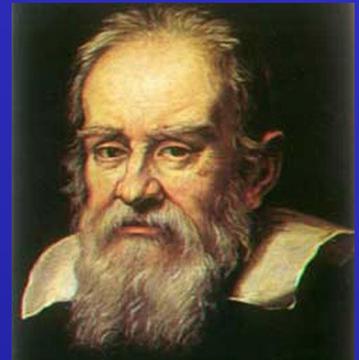
- A few data
- Evaluations by experts and expert groups
 - But no evaluation of the level of their expertise
 - As far as I know there was only one evaluation of the level of my own expertise (by Goossens and Cooke) but the result was never communicated.
 - There is a significant probability that my score was not good at all
 - But would the score of the other experts be any better?
- The problem here that there is not much to go by.
- And you need an estimate whatever.

The fire-chiefs project

- Question: who has the most expertise of firefighting
- Firemen, math students or non-math students
- Answer: NON-Math students!!
- Conclusion:
 - The choice of seed questions is critical
 - They should be pertinent to the field and
 - The answer should not be public knowledge.

And also

- Experts who know the Cooke system can play the game:
- They can increase the interval around their estimate to make sure the “real” answer is in the interval.
- From the air-transport study: It is sometimes better to just ask the one real expert, but it is sometimes difficult to find here/him



Where does that leave us with 10^{-6}

- It still is the best guess
- There was only little data to support the number
- But that has not improved over the last 40 years
- So for now we are stuck with the number.

Swans

- Were all white
- Until 1697
- They proved to be black ones too
 - Willem de Vlamingh



But what does this mean for

GREETINGS PROFESSOR FALKEN

HELLO



A STRANGE GAME.

THE ONLY WINNING MOVE IS
NOT TO PLAY.

HOW ABOUT A NICE GAME OF CHESS?

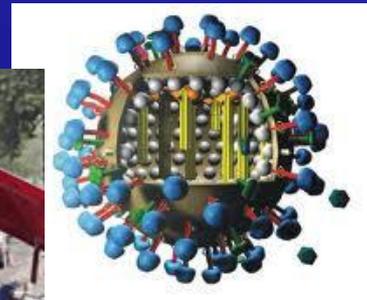
The gate in Veere (feb 2012)

- Opened by children thinking it was a game
- Username “veere”
- PW: “12345”



What does this mean for

- Hacking governemental computers
- Pathogens
 - Measles in America
- Triffids
- Blue unicorns
- Fire throwing dragons



Dragons

- There are millions of books about dragons
 - (and there was not one about black swans)
- Do we need an anti dragon defense shield
- And if we think we don't, what are we going to say when one appears.



Expert opinion

Just as safe as the Eurocode



Expert opinion

- Experts agree that dragons do not exist
- Experts also agree that low interest rates are good for us
- That we can live near high voltage lines
- That we should reduce CO₂ emissions
- That after 75 years your life is complete
- They used to agree that the earth is flat
- That the earth is in the middle of ALL.
- That gas extraction in Groningen does not cause earthquakes.

$$f_{final} = \sum w_i$$

The giant coffee-table of alternative facts

- $10^{-6} = \text{zero}$
- The Ford T-model was designed for bio-fuel
- Electrical cars produce less CO_2
- Science is just another opinion
- Risk perception is better than risk evaluation (min VROM)

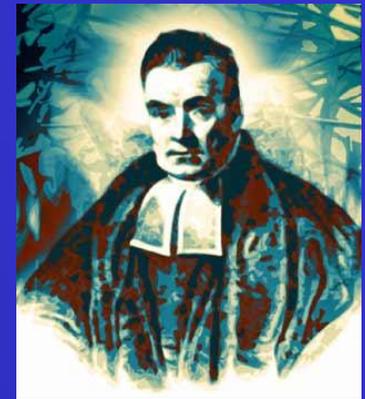
Not new

- “If it serves my policy better that $4 + 4 = 4,5$ than it shall be 4,5
- (Neelie Smit-Kroes, Minister of traffic and waterdefence 1982-1989)



Roger's message

- The only certainty is death
- Measuring is better than guessing
 - We assume
- There is no guarantee that an expert is “right”
 - Not even Bayes
- Unfortunately there are no experts that know all
 - Not even in their own field
- Organized expert selection helps to find the right expert(s)
- And organized expert opinion elicitation helps to find the best estimate



Reverend(!)

Decision making in uncertainty

- Use an organized method to ask experts
- Deal with uncertainty the Bayesian way
- Continue fight against the anti-numericals

