

International Conference on Opportunities and Challenges for Water Cooled Reactors in the 21st Century

Risk Concept in Nuclear Industry (Overview)

Réka Fótos

Advisors: László Tóth, Péter Trampus

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Outline

- **Role of risk concept;**
- **Importance of risk concept;**
- **Risk-based / Risk-informed;**
- **Benefits of Risk-informed concept;**
- **Main steps of Risk-Informed concept;**
- **Risk-Informed concept in nuclear industry;**
- **Future plans;**
- **Conclusion.**

Role of risk concept: Engineers vs. Economists

- Privatization → profit came into the limelight



reduced inspection efforts



boundless consequences



Engineers $\langle == \rangle$ Economists

- Risk-informed concept = communication interface



Engineers



Economists

Risk-informed / Risk-based

Deterministic

**Worst-
case
scenario**

Risk-informed

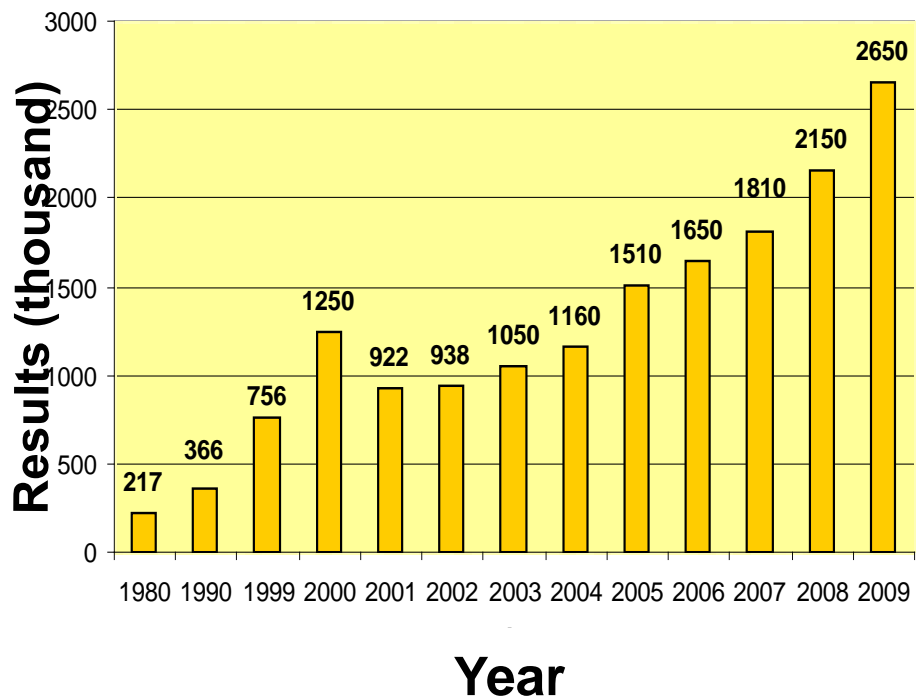
- Risk insights;
- Deterministic information;
- Certificated basis data;
- Historical data;
- Operational experience.

Risk-based

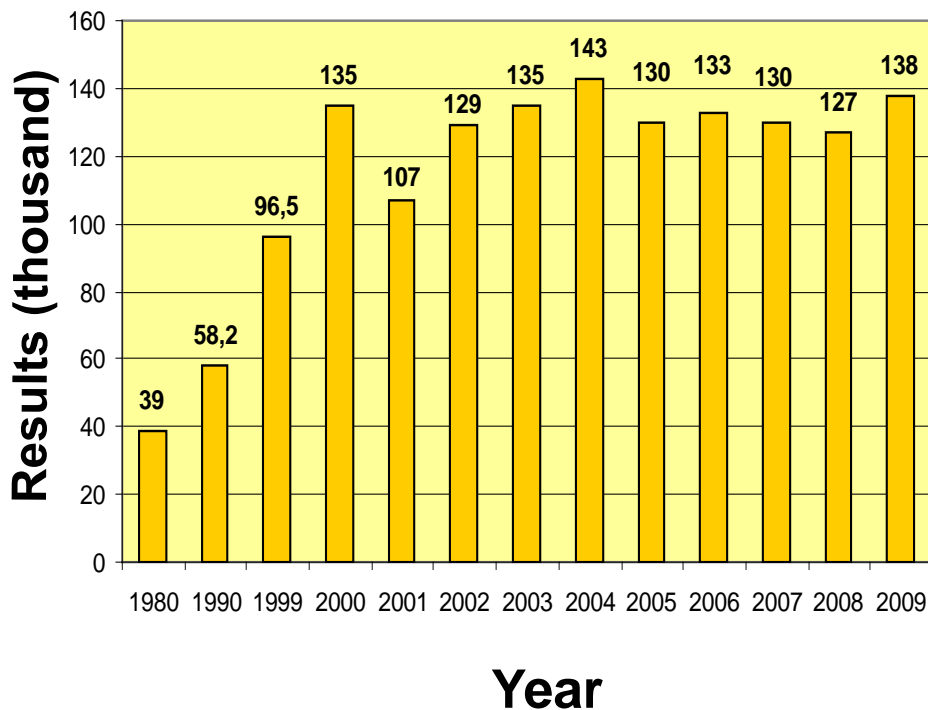
**Absolute
risk
values**

Tendency of risk concept in industry

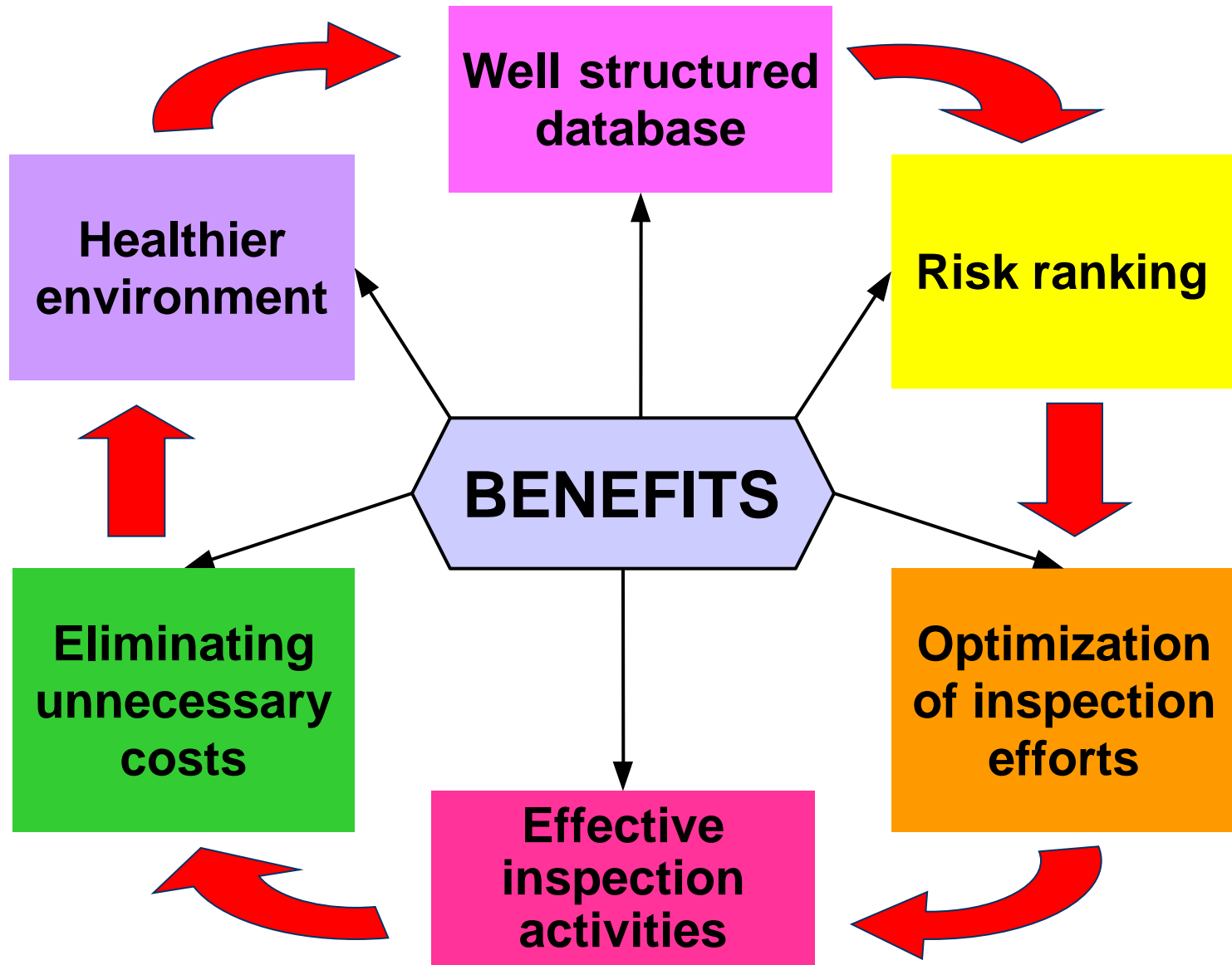
Results for Risk-based expression



Results for Risk-informed expression



Benefits of Risk-informed concept



Further outcomes of risk concept

- Increasing of performance;
- Effective operation of aging plants and equipment;
- More safety work circumstances for workers;
- Optimal exploiting of resources;
- Competitiveness;
- Decreasing of outage time;
- Meeting the strict safety and environmental requirements;
- Maintaining the safety and reliable operation;
- Increasing of operating time.

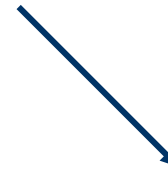
Main principle of the concept

The application of risk analysis principles to manage inspection programs.

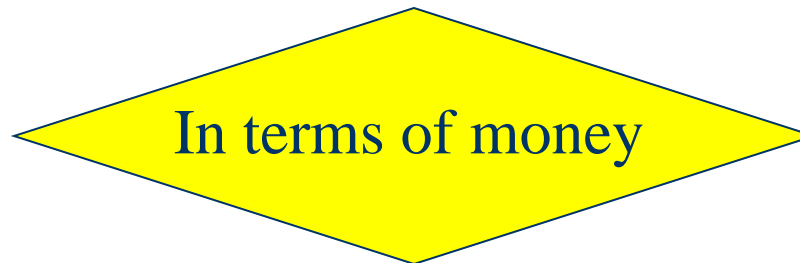
Risk = Probability x Consequence



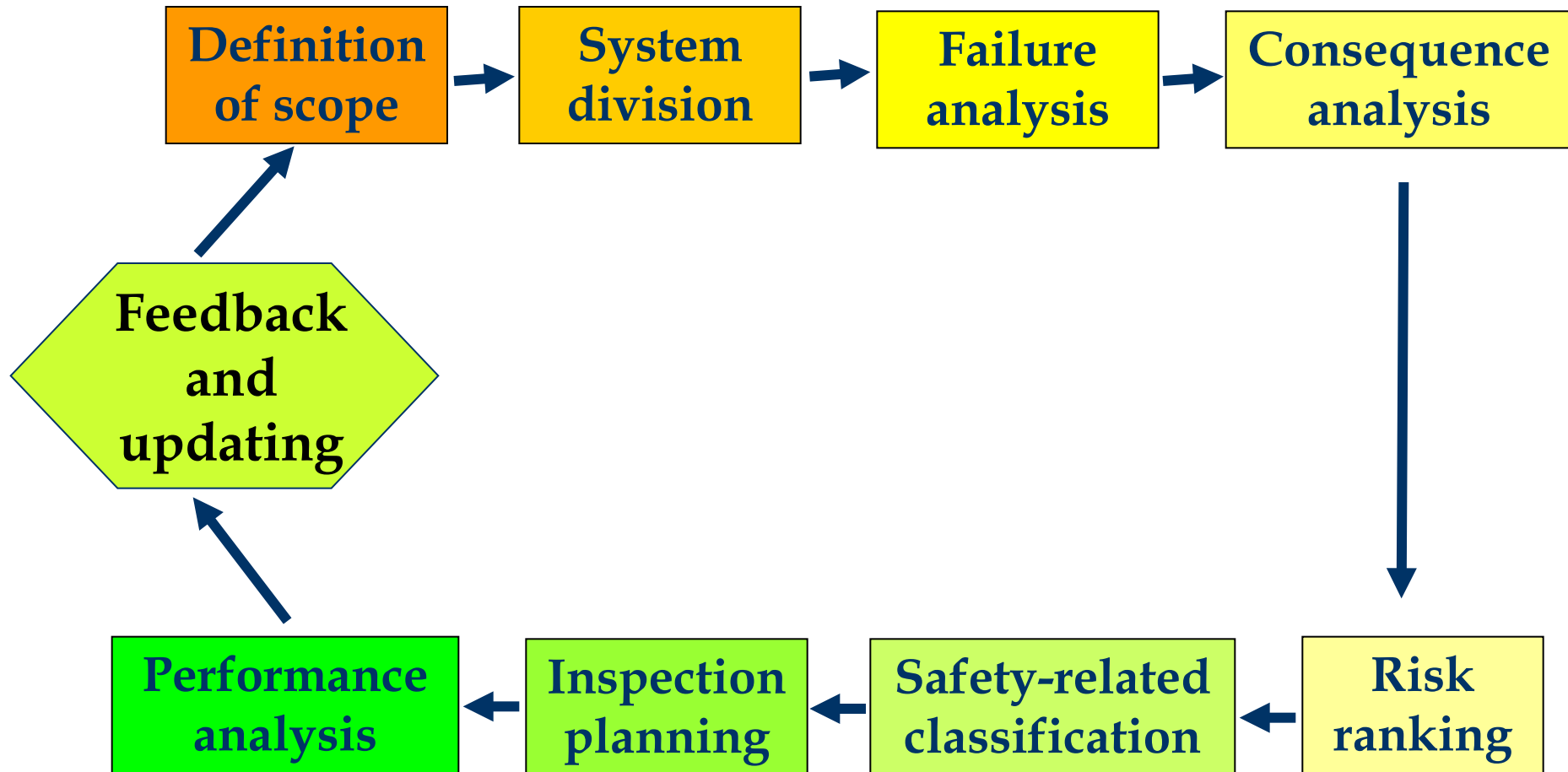
Probability of Failure



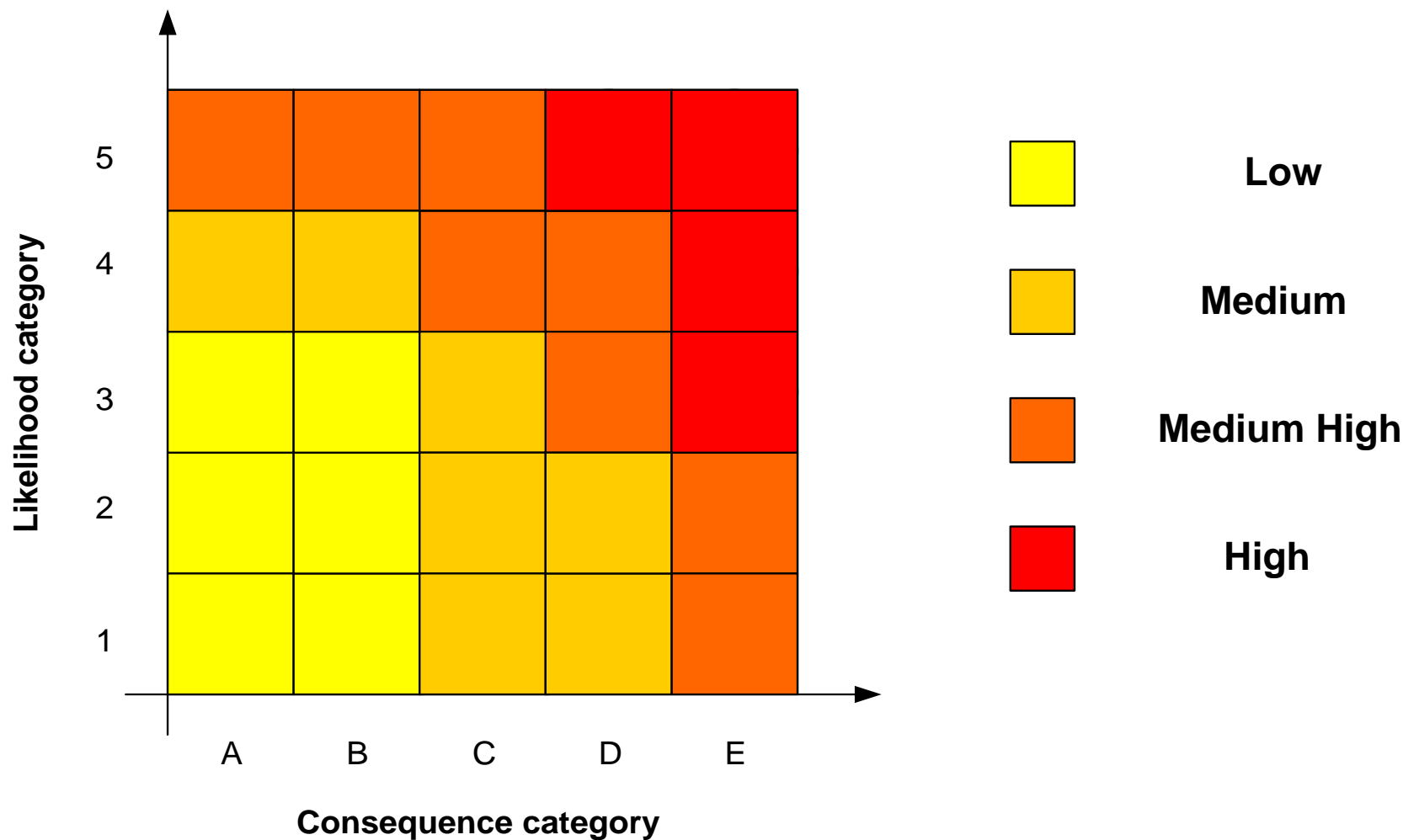
Consequence of Failure



Main steps of Risk-Informed concept



Tool of risk ranking: Risk matrix



Risk-Informed concept in nuclear industry

- more methods are carried out;
- the main principles are the same;
- qualitative and quantitative methods;

Qualitative

Have the same interpretation;
Less biased from personal judgment;

Quantitative

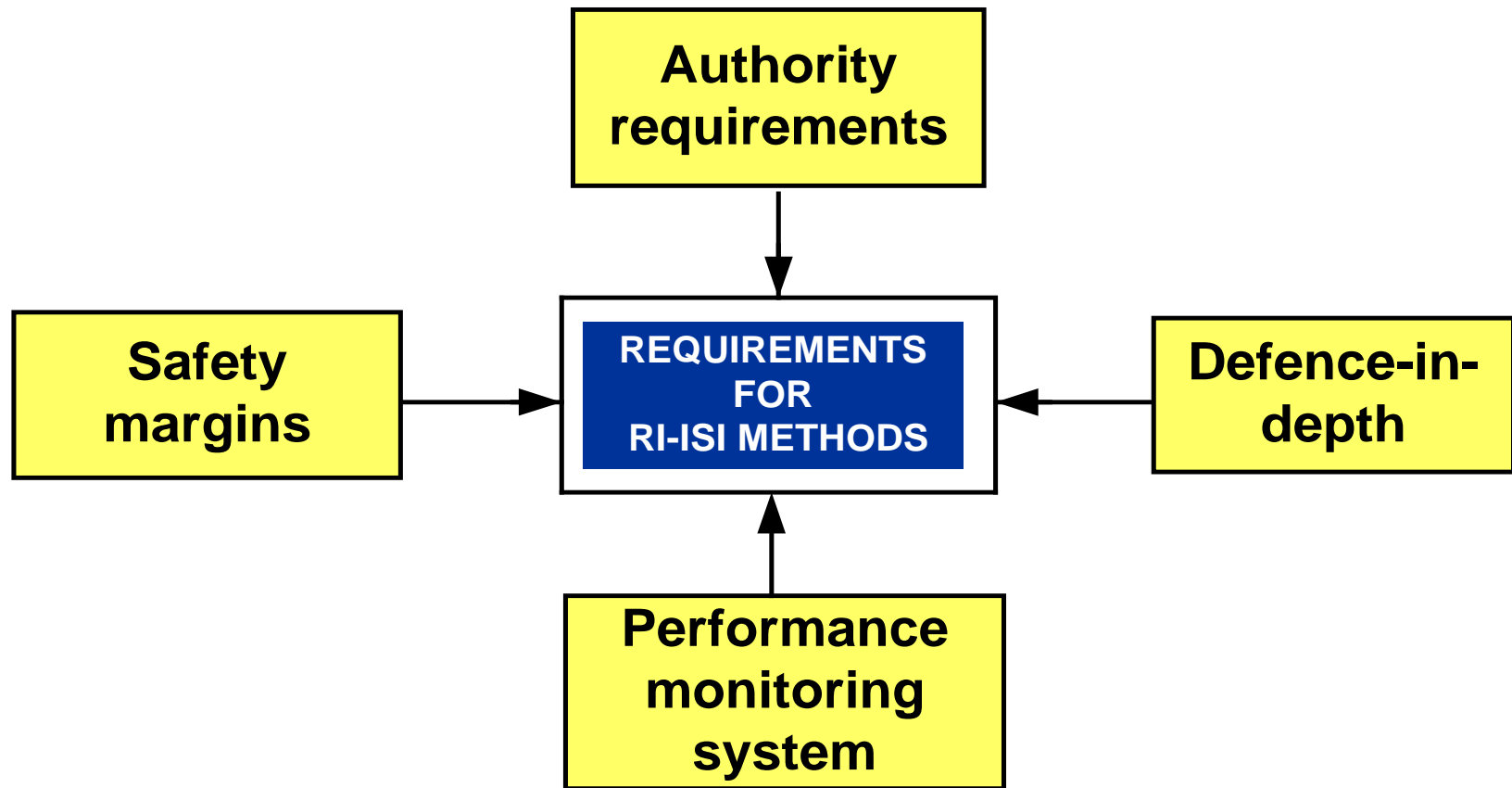
Can be misinterpreted;
Not simple to communicate;
Less detailed;
Emphasize the most important features

RI-ISI methods:

- EPRI method;
- OMF-Structures;
- STUK method;
- WOG method;
- DNV method.

Risk-Informed concept in nuclear industry

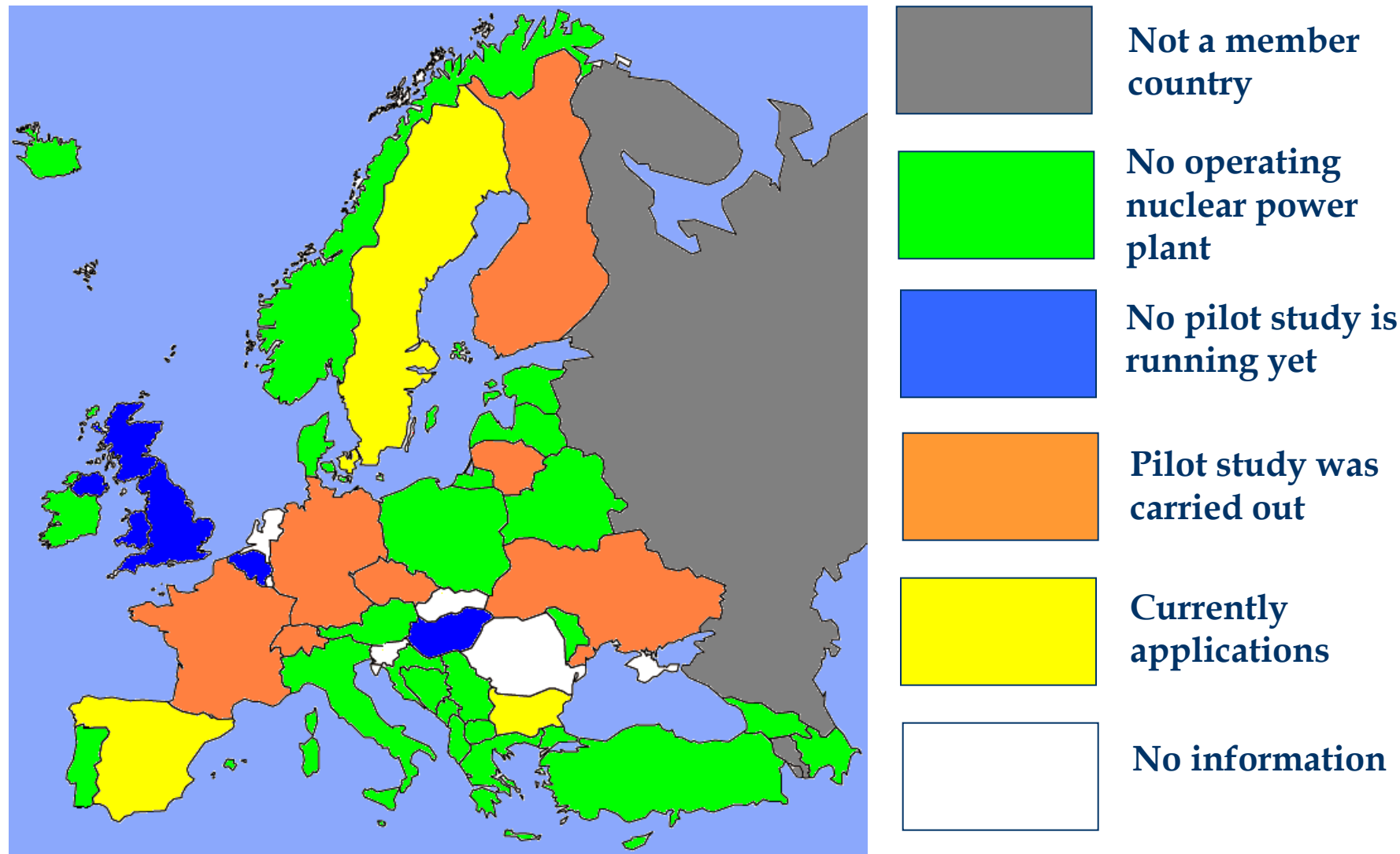
RI-ISI = Risk-Informed In-Service Inspection



Current status...in the world

- RI-ISI of piping has become one of the practical ways of NPP inspection;
- RI-ISI is used widespread;
- More than 50 units had been licensed for implementing RI-ISI in US;
- The methods are applied in European countries in **pilot projects** and in **actual applications**.

... in Europe



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Summary of RI-ISI

In general: The **cost-effective** risk-approach is spreading in technical-economical segment of our life.

Specialties in the nuclear area:

- Regulatory view are different;
- The further consequences much higher;
- Promote – skeptical;

Despite these facts most of the countries deal with the possibility of the implementation of RI-ISI.

Future plans

To apply and implement risk-informed in-service inspection concept for a pipeline system in Hungarian NPP, - to explore the possibilities for improvement of the methodology.

- Analyzing the current RI-ISI methodologies ==>

EPRI method was chosen

- Selecting a pipeline system for analyzing ==>

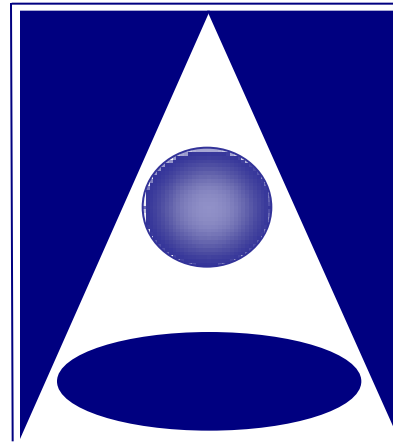
1. High pressure safety injection system

Not good idea: there are not so much damage mechanisms and consequence categories ==> not good for demonstration purpose

2. Main circulating pipeline system ✓

Conclusions

1. Risk-informed methodologies play more and more important role in the everyday practice.
2. The applications of Risk-informed methodologies in different industrial sectors are based on well developed standards, guidelines.
3. The nuclear applications of RI-ISI methodologies are expanded all round the world.



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Thank you for your attention!

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