

THE SAFETY CASE

Concept, History and Purpose

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PAAG-15 (Oct.1999)



IPAG-3 (June 2000)



Plan of presentation

- Review of major milestones and consolidation stages
- Where “safety case” came from
- Quick revisit of concepts
- Major conceptual changes in the past 10 years
- Future developments (...here and there..)

Major Milestones - 1

- **SYMPOSIUM (1989)** ... *where do we stand; recognising challenges ahead, but also “acritical”/reassuring*
- **GEOVAL (1994)***validation...not a good concept to be referring to...confidence building (Intraval, Chemval, ..)*
- **IPAG-1 (1995-1997):** *recognition that a safety study is much more than PA ... a host of observations (documentation,, stylised scenarios, contents,...)... safety case...beginning of a series of critical studies*
- **Ad-hoc group on validation/confidence building (1996-1999)** : *the formulation of current concept of safety case...terminology... embedding in wider societal confidence aspects*

Major Milestones - 2

- **ICRP-81 (2000):** *potential exposures; sound engineering principles; [rad prot calculations no longer the central argument over the LT]*
- **EC SPIN Report (2003):** *confirming that there exist viable safety/performance measures outside classical Rad Prot*
- **Integration Group for the Safety Case (2000-...):** *enhancing the integration of site, engineering, management, and classical PA experts, and forwarding the safety case*
- **IGSC Timeframes Initiative (ended 2006):** *a lot is good, but not all is done; help by other constituencies useful*
- **INTESC and LTSC initiatives (ongoing) ?**

CONSOLIDATION of KNOWLEDGE

- **NEA SAFETY CASE BROCHURE (2004)**
- **IAEA WS-R-4 (2005)**
- **This Symposium (2007)**

VOCABULARY

(IPAG-1)

Definitions given; most studies fell in SA and SC categories

Performance analysis	Safety analysis
Performance assessment	safety assessment
Safety case	

“Safety Case” was in the air

- 79. Forming a judgment ...The *safety case* provided by the repository operator will need to address all these issues. ...good engineering practice, good science..
- 80. while calculations can inform a judgment, *other* technical factors, of a more qualitative nature, .. The Government, therefore, considers it inappropriate to rely on a specified risk limit or risk constraint as the criterion for determining the acceptability of a disposal facility. [*UKDoE Consultation Document, 1994*]

CONTENT OF SA REPORT

(IPAG-1)

A possible skeleton for a SA report

- **Programme context**
- **Regulatory criteria**
- **Objectives and scope of the assessment**
- **Description of the system at the conceptual level**
- **Statement of the constraints**
- **Approach to safety assessment**
- **Detailed description of the disposal system**

CONTENT OF SA REPORT (cont'd) **(IPAG-1)**

- **Interpretation and elicitation of databases**
- **Scenario development (or analysis)**
- **Description of models**
- **Results and interpretation**
- **Confidence in key arguments**
- **Compliance with regulatory criteria**
- **Conclusions**

Purposes

(IPAG-2)

- Background work useful for insights into site selection.
- Feedback to R&D
- Permit full scale operation as part of license renewal
- Partial license, such as concession for use of underground
- Aid regulator and applicant to prepare for licensing
- Basis for determining feasibility of concept for disposal
- For supporting a decision, in general...

Major Conceptual Changes - 1

- Traceability – Transparency [*documentation*]
- FEPs treatment [*starts now from knowledge basis*]
- Multi-barrier/defence-in-depth [*safety functions, indicators, .*]
- Integrated teams / Management of uncertainty as “managerial” approach [*Bias audit, ..*]
- Complementary arguments/considerations [*à la SPIN*]
- Acknowledgement of international developments

Major Conceptual Changes - 2

- Methodology [*Qualitative analyses, what-if cases..*]
- **OVERALL**: modern safety cases that resemble more and more the desiderata of the NEA “confidence document” and the NEA “safety brochure”

Confidence vs. uncertainty - 1

- **Uncertainty will exist in any human endeavour**
- **Decision making has always to take uncertainty into account. The real issue for decision making is that of confidence**
- **Decision making need not be based on a numerical value for uncertainty**
- **Confidence does require that “uncertainties” have been dealt with**

Confidence vs. uncertainty - 2

- When it comes to *scientific uncertainty*, there are means to deal with that, which are the typical ones applied in data analysis and model testing
- When it comes to *long-term predictions* we get out from the narrow scientific domain. A mixture of *quantitative* and *qualitative* analyses and arguments (still science-based) will have to be provided to engender confidence of both the provider and the reviewer.
- *The reasons for this confidence, in support to the decision/application at hand, should be stated.*

Direction: Confidence

- **Shift from Performance Assessment (PA) to Safety Case (SC)**
- **PA is part of SC not its driver**
- **PA implies prediction/validation; SC is about confidence**
- **PA is science product independent of Decision Making (DM); SC is for DM and is informed by science**
- **SC is what society needs in terms of confidence for the decision at hand.**

SAFETY ASSESSEMENT

(i) Establish an **ASSESSMENT BASIS**

- define a **safety strategy** that describes a suitable approach to the building of a safety case
- define the repository site and design (system concept)

(ii) Carry out a **PERFORMANCE ASSESSMENT**

- evaluate repository performance for the assessment cases,
- assess compliance with acceptance guidelines
- carry out sensitivity analyses

(iii) **EVALUATE CONFIDENCE** in the calculated safety and modify, if necessary, the assessment basis

(iv) Compile a **SAFETY CASE**

- document the safety assessment
- document **confidence** in the safety indicated by the assessment

Interact with decision makers and modify, if necessary, the assessment basis

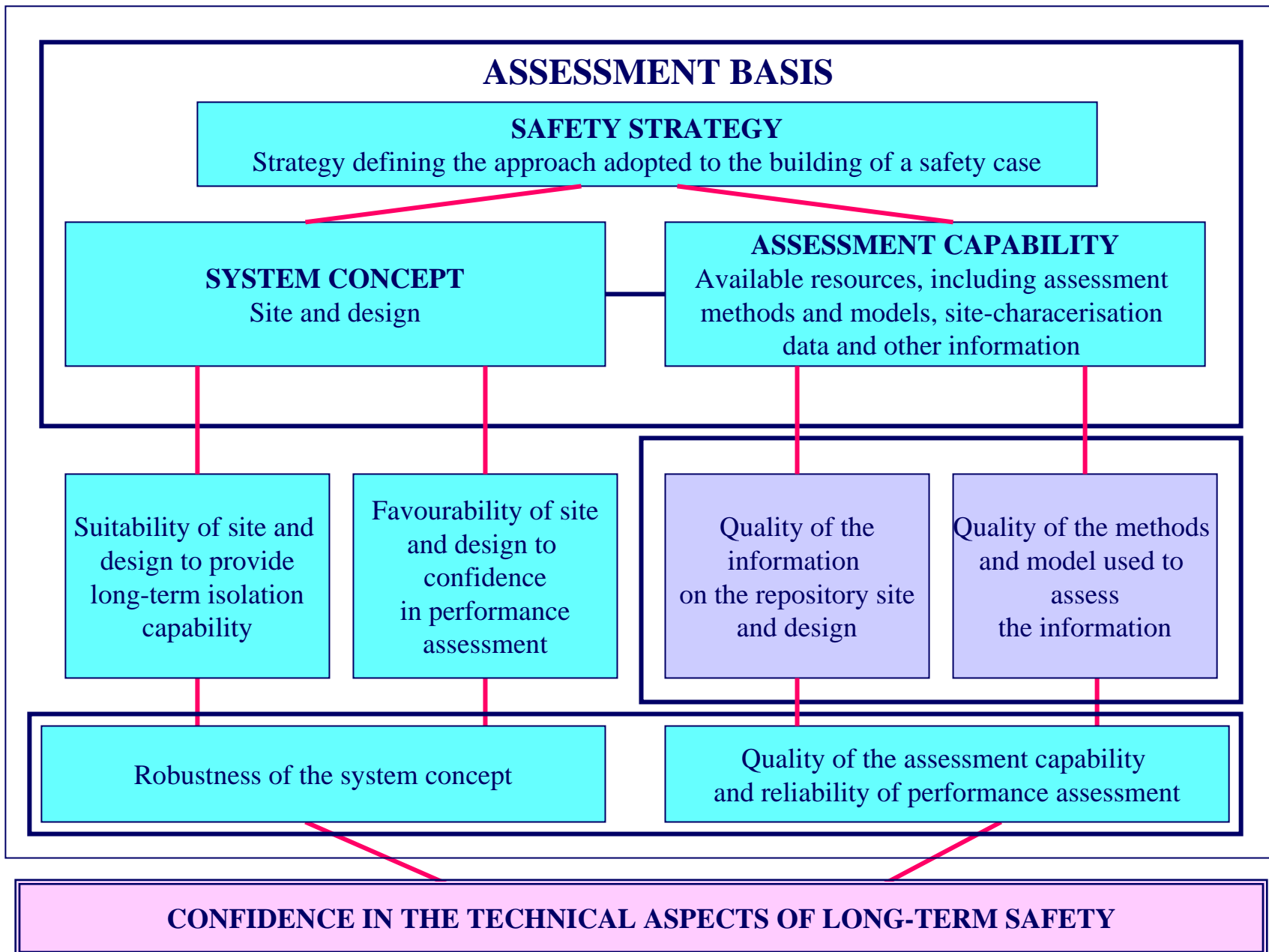
⊗ Strategy for achieving safety, i.e., a robust system concept

- avoiding or forcing to low probability or consequences most phenomena and uncertainties that could be detrimental to safety and its evaluation through the choice of site (NA...) and design

✧ STRATEGY TO ARGUE SAFETY

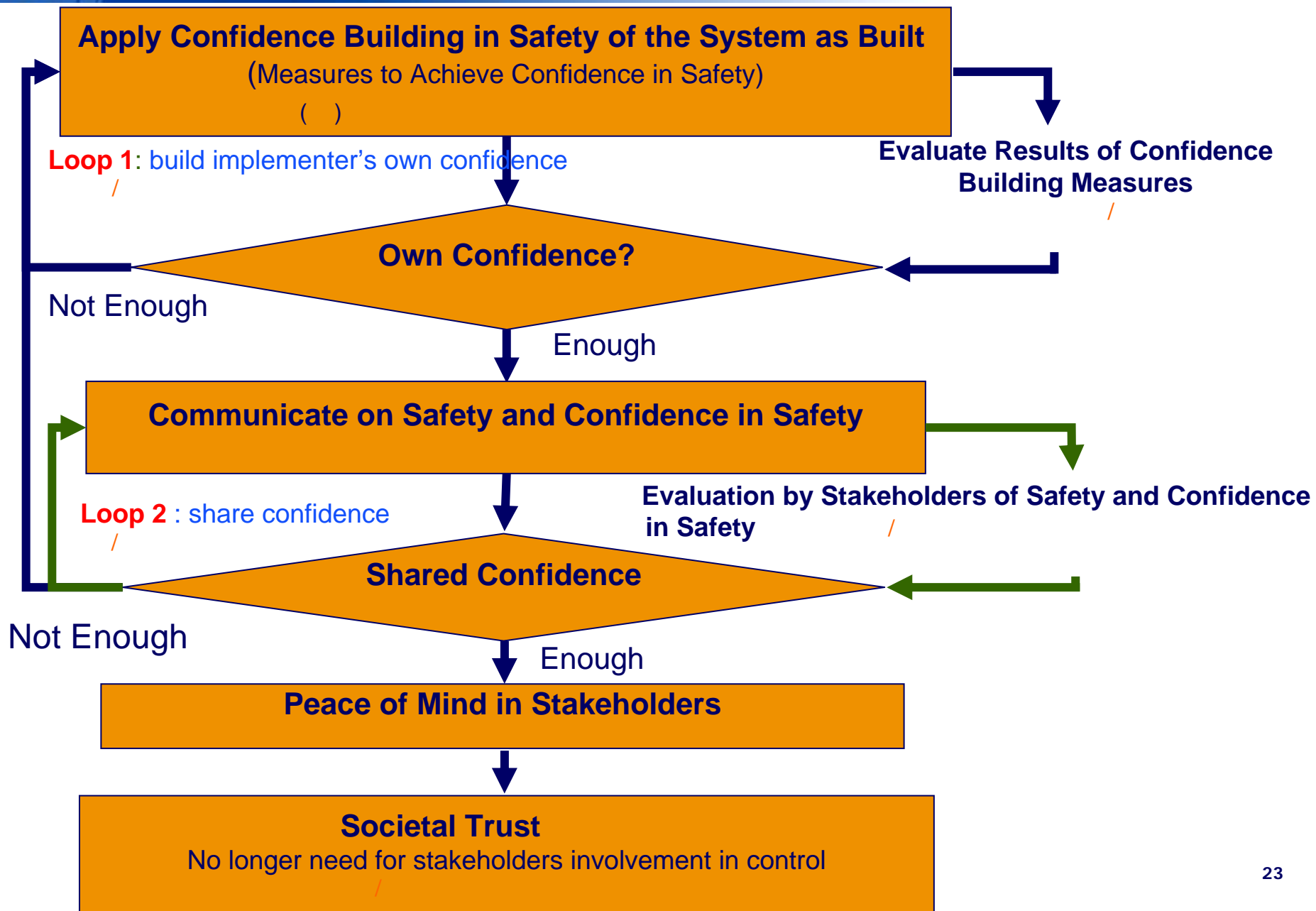
- Declare role of barriers and system functions
- Identify and explain assessment cases
- Verify quality of tools, data, analyses
- Explain that PA is for testing system performance
- Analyse system beyond design basis and regulatory compliance points
- Use other indicators of safety and performance.....

Taken from Confidence document 1999



NEA Peer Review Guidance document (2006)

- Over 40 items to test safety case and one's own approach in view of enhancing own confidence and that of others
- See application to Nagra's "Entsorgungsnachweis"



Conclusions

- We have achieved a lot these past ten years. In particular, we have moved on from this:
- “... *the assessment of risk has carried its own risk – namely, an undue reliance on logical quantitative techniques that fail to address the root causes of public concern and apprehension.*” [Armour, 1997]

Thanks

