



Nuclear Energy Safety – A systems Approach

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Nuclear Energy Safety – A systems approach

- **Some Background information...**
 - NES and the IAEA
 - A processes view of Systems Engineering
 - The V-model. Baseline management
- **NES management the SE way:**
 - Defining “the industrial system”
 - Safety versus Safety Assurance
 - Achieving safety Assurance for the New Build Program
 - New Build Program stakeholders
 - Baseline management of New Build
 - Problems downstream....
- **Implementation: two NRF-supported projects**
 - Presentation by Lüka Potgieter
- **Conclusion – Validation is the ultimate aim**

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Nuclear Energy Safety and the IAEA

- The IAEA has no jurisdiction in any of its member states
- IAEA provides safety requirements & guidelines
- Member states should establish their own legislative system that will ensure a high level of safety for protection of people and the environment

IAEA safety requirements & guidelines

- Contained in some 125 documents
- 30-300 pages each
- Most with 20+ references
- At 10 minutes per page – 41 Years worth of reading!

EXAMPLE: Format and Content of the Safety Analysis Report for Nuclear Power Plants

Paragraph 3.32 Hydrology “For coastal and estuary sites, tsunamis, seiches and the combined effects of tides and strong wind should be evaluated.”

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...And while we are talking about Fukushima:

Generation IV International Forum



REPORT ON GIF MEETINGS, LUCERNE, OCTOBER 2011

(Dr. Van Zyl de Villiers, NECSA Strategy and Performance)

According to the Risk and Safety Workgroup of GIF:

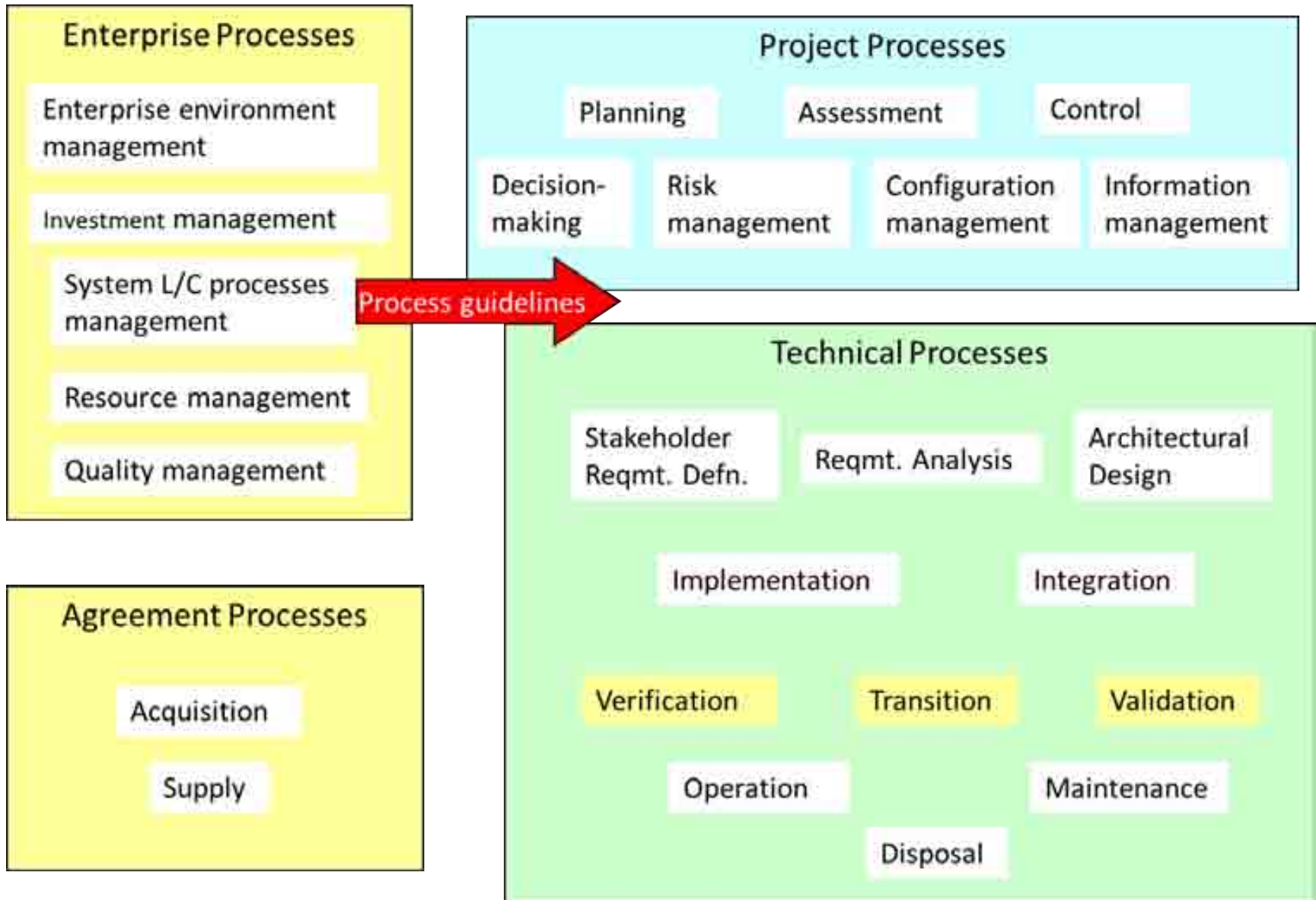
Integrated Safety Assessment Methodology



During discussions on the ISAM it was stated by some participants that even this comprehensive methodology would not necessarily have identified the possibility of the unique combination of natural events that occurred at Fukushima. The challenge therefore remains with the proper application of methodologies of this nature and not necessarily the methodologies themselves.

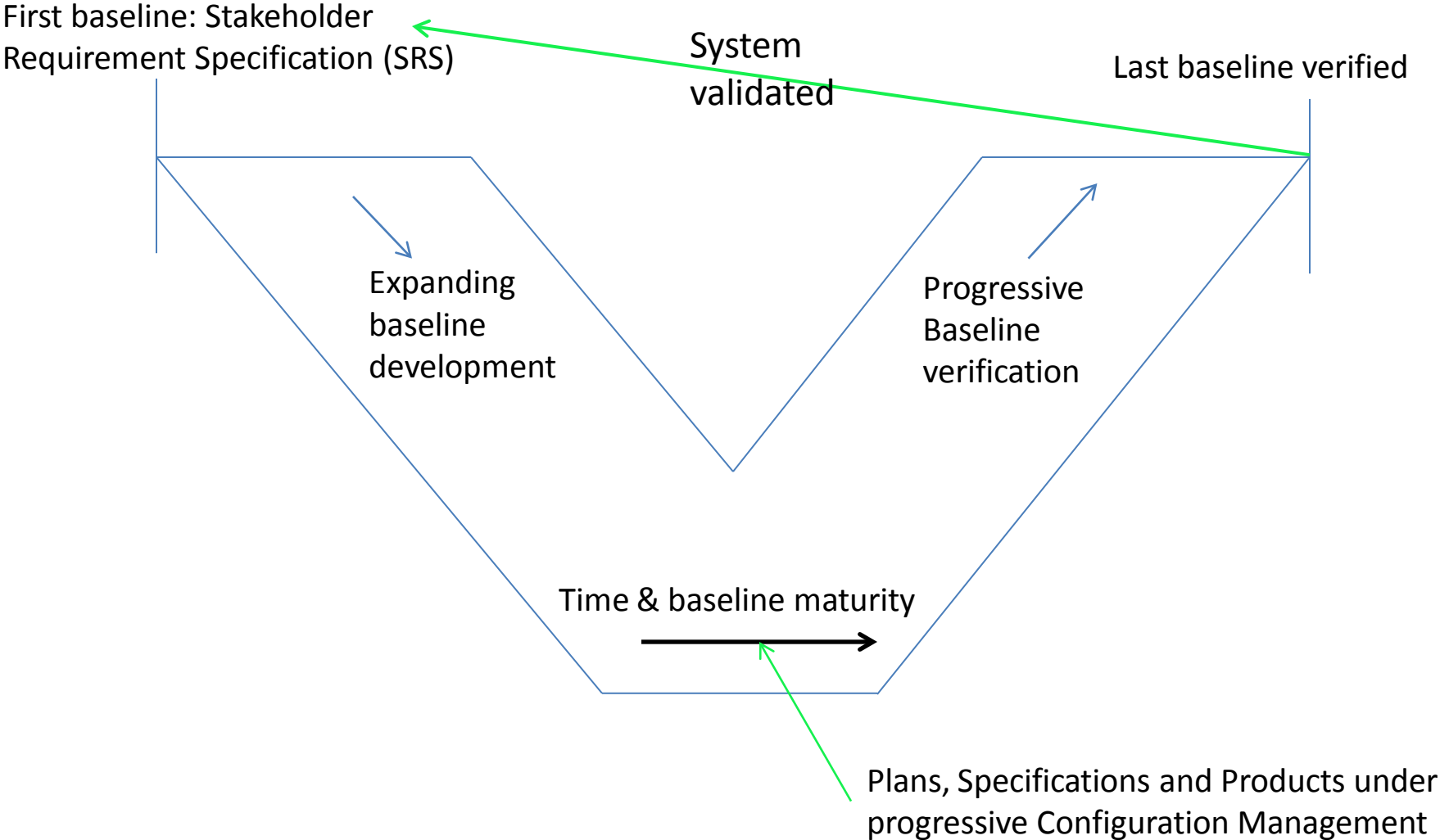
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A processes view of Systems Engineering (INCOSE Handbook 3)



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The V-model. Baseline management

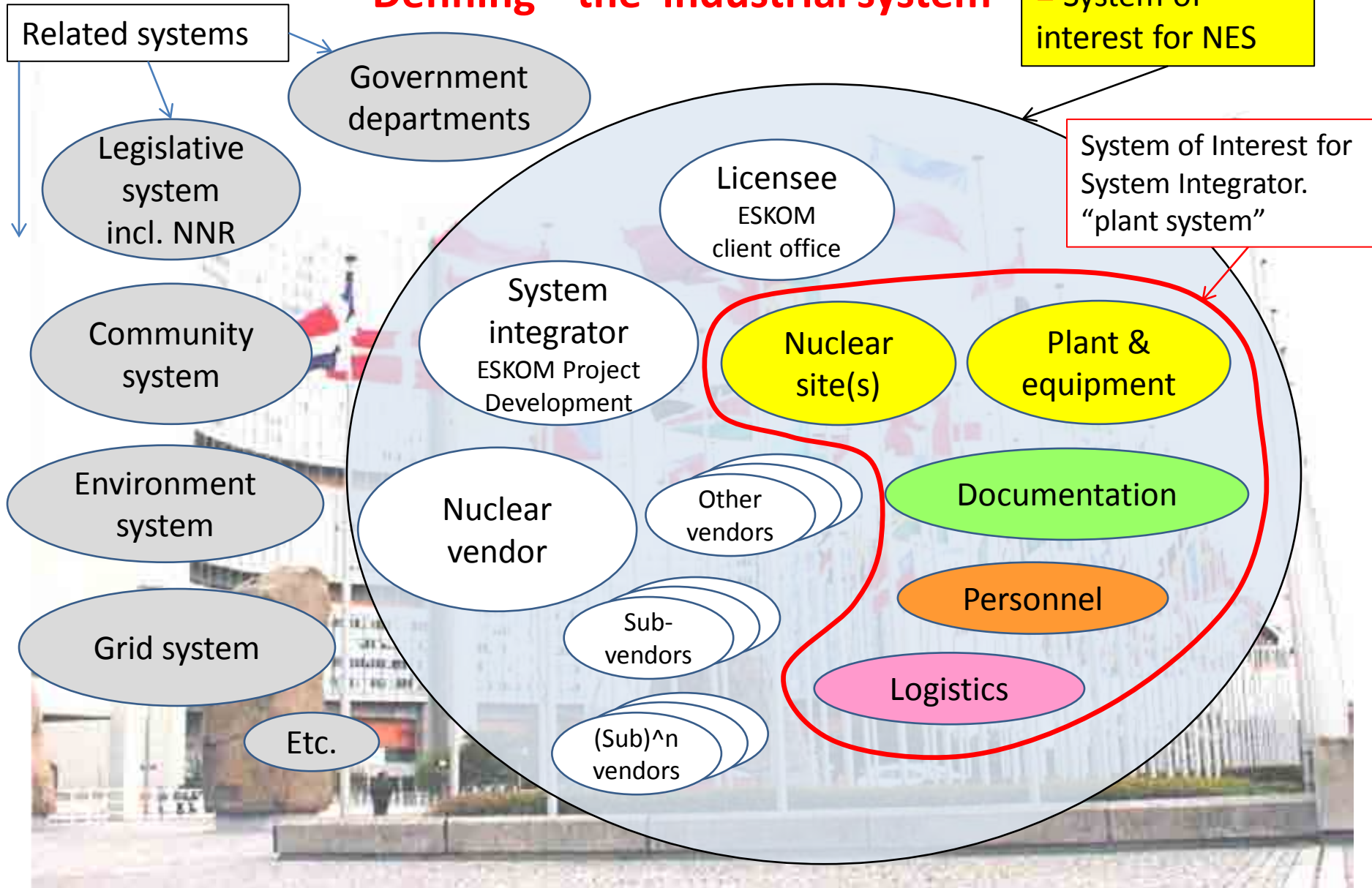


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Defining “the industrial system” = System of interest for NES



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Safety vs. Safety Assurance

In the systems approach to Nuclear Energy Safety we **want to be sure** that:

- The industrial system produces a safe Nuclear Plant System
- The Nuclear Plant System will operate safely throughout its life
- The Industrial System is capable of supporting the Plant System over its full life
- The Nuclear Plant System can be de-commissioned safely

NOTE: I distinguish between safety and safety assurance:

- **Safety** is one of many characteristics of the system
- **Safety assurance** a process whereby the safety of a system is systematically monitored, evaluated and improved

How can **safety assurance** be achieved for the NEW BUILD program?

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Achieving Safety Assurance in the New Build Program

How can **safety assurance** be achieved for the NEW BUILD program?

THERE IS ONLY ONE WAY HOW IT CAN BE ACHIEVED:

Safety assurance must be baselined and formally contracted throughout the contracting chain

It follows that the **process to monitor and evaluate safety** must be baselined and contracted top down to the lowest contract level

Baselining is a process in its own right. It involves many steps, one of which is the identification of the system's stakeholders

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Identification of the New Build Stakeholders

Stakeholder: (INCOSE Handbook 3)

- A party having a right, share or claim in a system **or**
- A party having a right, share or claim in the characteristics of a system that meet that party's needs and expectation.

Test:

- Should the NNR be identified as a stakeholder ?

YES. NNR's mandate is assurance of public safety; safety is a characteristic of the system. NNR has a right to this characteristic. **Note:** NNR is not part of the industrial system

Test:

- Should the local community be identified as a stakeholder?

YES. Locals need the system to be safe. They have a right to this characteristic; Locals expect job opportunities. They should share in the job creation characteristic of the system

Test:

- Should the media be identified as a stakeholder?

From a SE point of view: **NO**
From a project governance point of view: YES, in the interest of transparency and openness

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Identification of the New Build Stakeholders

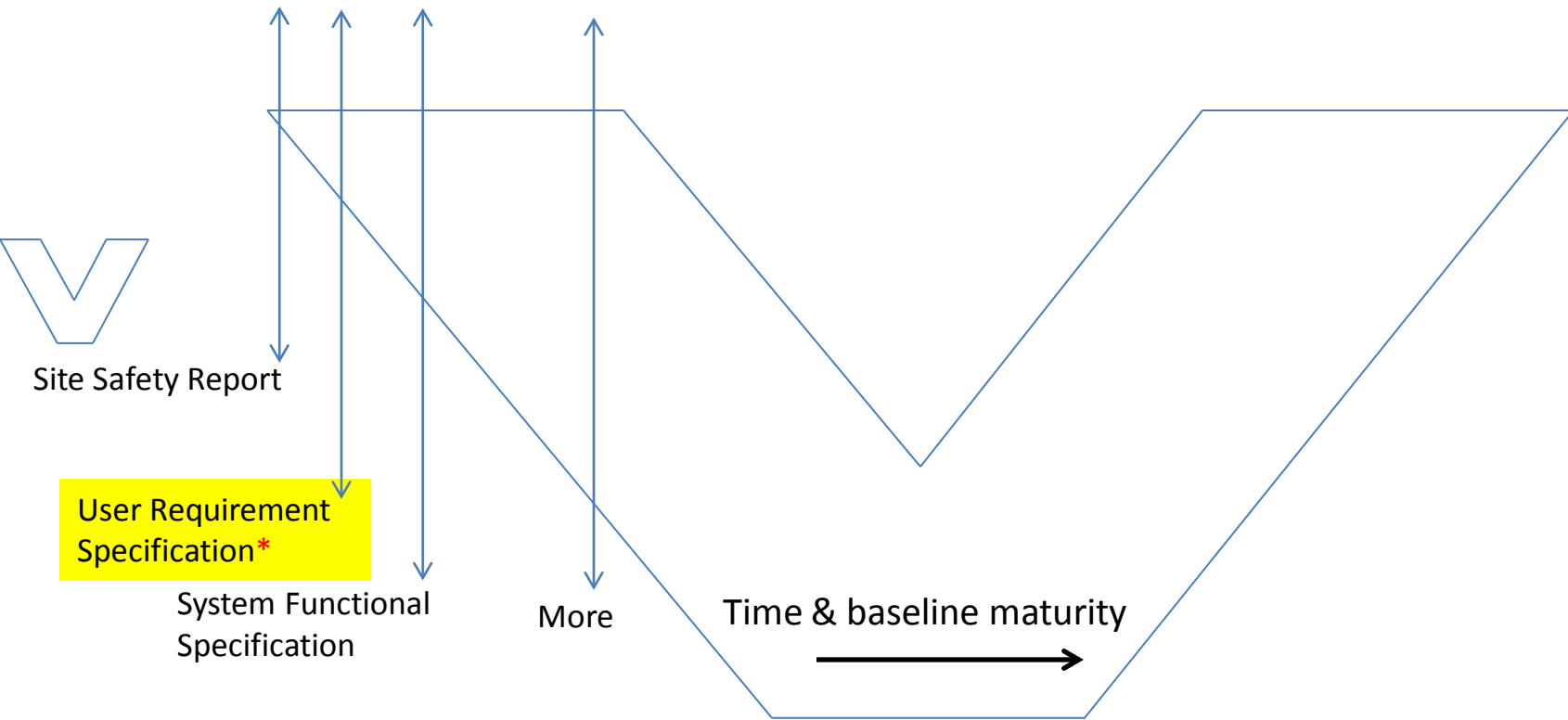
IAEA document NG-T-14

Title: Stakeholder involvement throughout the life cycle of nuclear facilities

Makes interesting reading!

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Baseline management: New Build



* If the SE approach is followed, read **STAKEHOLDER** Requirement Specification. Hence the needs and expectations of all stakeholders should be included in the SRS

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Problems downstream.....

A universal truth: Problems down stream are symptoms of neglect upstream

ESKOM is currently in the process of drafting the URS for Nuclear-1

If the systems approach is followed one would expect that

- All Nuclear-1 stakeholders have been identified
- ESKOM Client Office is compiling a SRS (rather than a URS)
- Requirements relating to system safety and **safety assurance** are separately and explicitly addressed

Is this being done?

I don't know

Herein lies the problem: Lack of visibility and transparency

Herein lies the academic challenge: **The Inter-Organizational Nuclear Knowledge Management System**

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In Conclusion: Validation – the ultimate aim

Validation – **does the system - “as built and as operated” - comply with its SRS?**

It follows that, according to the systems approach to NES, the ultimate safety (and safety assurance) of Nuclear Energy is determined by the first baseline – its SRS

Hence

- We better specify it
- We must make sure that it is properly promulgated throughout all baselines
- We must make sure that it is properly contracted at all levels
- We must make sure that compliance is monitored throughout the project (and system) life cycles
- We must make sure that non-compliance is rectified

And all of this must be transparent and visible for any body to see...

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In Conclusion: Validation – the ultimate aim

To make it work in practice we need buy-in from:

- **the NNR**
- **ESKOM**
- **and the Government: DoE, DST, DTI**

Thank you!