# Safety culture lessons learned from nuclear new build projects in Finland

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# Introduction 1/2

- There have been two major nuclear power plant (NPP) construction projects in Finland during the last decade
- Strong focus on nuclear safety is required from the very beginning, in order to avoid immediate and latent defects
  - Despite a turn-key contract, the plant owner (and future operator, licensee) is responsible for nuclear safety from the beginning
- Nuclear power plant construction projects are complex endeavors involving hundreds of companies from all over the globe
  - Organizations with various degree of experience in nuclear domain
  - Design organizations, manufacturing organizations, construction, technical support etc.
  - Organizations with differing cultures, including national cultural differences based on the base of operations

# Introduction 2/2

- Together with the coauthors, we have cumulatively more than 20 person years of work experience as safety culture specialists and consultants in Nordic nuclear power plant construction projects

- The presentation builds on our experience and lessons learned during the period from 2006-2022 – a two-day lessons learned exercise facilitated by a research scientist (the second author)

**We propose a set of questions that each nuclear new build project must ask and find a shared solution**

  ◦ **We will also provide example of constraining questions that easily lead to misuse of the safety culture concept**

By safety culture we mean "assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, protection and [nuclear and radiation] safety issues receive the attention warranted by their significance" (International Atomic Energy Agency). We use Schein's model of culture to elaborate IAEA's definition (levels of culture; artefacts, values, assumptions).

We identified four categories of questions that need to be discussed in the project

Questions about definition of concepts

Questions about assessing and influencing culture

Questions about the added value of safety culture

Questions about the importance of context

# Safety and safety culture need to be defined

## What is the safety in question?

- ◦ Nuclear safety is abstract in pre-operational phases - occupational safety issues easily dominate

## How safety culture is defined?

- ◦ It is up to the organization to decide whether "safety culture" refers only to nuclear safety or does it include the other types of safety too

## How does safety culture affect (nuclear) safety?

- ◦ The preconditions for reliable and safe operation are created in design and construction phases – this needs to be clarified to personnel

## How does individual tasks contribute to nuclear safety & culture?

- ◦ In the end, everything affects nuclear safety, but some things affect more than others – grading of safety significance
- ◦ Differentiate various ways of affecting safety, e.g. directly by design solutions, indirectly by creating organizational conditions, competence, or culture of working

## How do you quantify safety culture?

- ◦ This is quite typical question for the senior management to ask, but it easily leads to simplistic solutions and lose the added value of the concept

# Once safety and culture are defined, the questions of assessment and influence can be asked

## How do we know if our safety culture is good or bad?

- Agree on what is a nuclear safety related event during design and construction – typical nuclear events such as reactor scram cannot happen
- Avoid simplistic measures, rather rely on periodic self-assessments & monitoring of artefacts

## How does one assure safety culture in the supply chain?

- Steer the culture in the supply chain rather than try to change it
- Grading of attention to most important suppliers
- Safety culture program versus safety culture

## How does one systematically influence safety culture?

- Leaders' dual role needs to be acknowledged – influence culture & part of culture
- Line organization creates culture, safety culture specialists can facilitate and monitor

## What exact behaviour and actions you want to see?

- This question is often asked if safety culture is a regulatory or contractual requirement
- Leads easily to overemphasis on easily counted and observable activities

# Understanding what is the added value of safety culture approach

## How does this differ from quality management?

- They complement each other
- Safety culture is the "missing link" between the quality of the management system, its implementation and the final product (QA => SC => QC)
- Safety culture focuses on the human and organizational drivers and barriers of quality

## What is the added value of the safety culture approach?

- Safety culture can remind about the nuclear safety effects of the preoperational phase – nuclear safety functions are easily focused on operational aspects and not on the construction phase
- It is a "conversation starter" for non-technical issues that may affect safety
- The main value of culture approach is in basic assumptions

## How do you certify safety culture or verify in audit?

- Once its importance is realized, management wants to make sure it is "under control" => again, danger of oversimplification

# Safety culture in a <u>nuclear</u> power plant construction <u>project</u>

## What requirements does the context set us?

- Project environment: High turnover, multicultural context with language issues, people inexperienced in nuclear, education from basic to doctorate, schedule pressures combined with heavy regulation
- What is good leadership & followership in this context? What do we reward? How do the contracts facilitate / hinder good quality work? How do we communicate in the supply chain?

## How to approach SC in nuclear power construction?

- A long term development program, not a safety assessment document to be sent to the owner or the regulator => first focus on development rather than assessment
- Build continuity into the management systems – key people may change
- Owner's management commitment and expectations important for the whole supply chain
- Talk about nuclear safety, build the connection to quality during construction
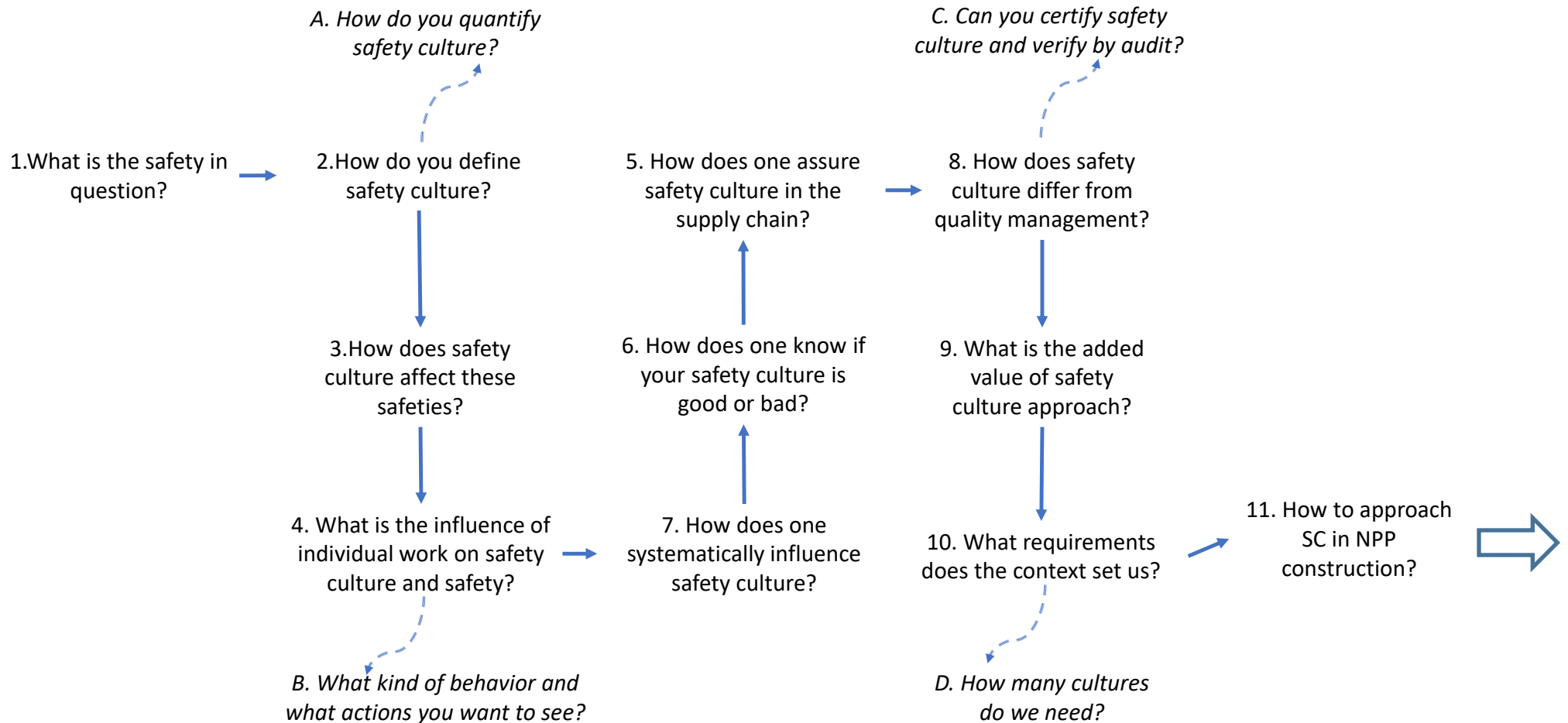- Danger of using business culture development programs in safety field

## How many cultures do we need?

- Senior management may sometimes think they need a "project culture" in addition to, or even to counteract, safety culture
- But, safety culture and company culture refer to the same phenomenon – develop a culture for safety, not "safety culture".

# Conclusions

- Every company needs to work out its own way of approaching safety culture
  - In a project environment, additional challenge is to agree on joint answers to the questions – communication and dialogue in the entire supply chain
- Safety culture development needs to be integrated into organizational development
  - Avoid overusing the "safety culture" term, rather talk about the contents of culture
- Schein's (and IAEA's) multilevel models of culture were found to be useful in explaining the various manifestations and deeper dimensions of culture to personnel
  - Rather than new models, advice on how to use existing models are needed – how to avoid the temptation to oversimplify safety culture
  - Relation between culture and other elements of the sociotechnical system need still to be clarified – culture, leadership, management systems, technology, regulation
  - Industry standard models need to be validated by research – but industry uses them anyway
- Systematic approach is needed to continuously monitor and develop safety culture
  - Based on a scientific approach, method development and help in balancing between depth and reach is needed
- To properly consider safety culture in a project environment, contracts and supply chain management in general is in a key role – conditions for good safety culture are created before the project execution starts

# Conclusions: the safety culture journey has a start but it never ends

*A. How do you quantify safety culture?*

*C. Can you certify safety culture and verify by audit?*

1.What is the safety in question?

2.How do you define safety culture?

5. How does one assure safety culture in the supply chain?

8. How does safety culture differ from quality management?

3.How does safety culture affect these safeties?

6. How does one know if your safety culture is good or bad?

9. What is the added value of safety culture approach?

4. What is the influence of individual work on safety culture and safety?

7. How does one systematically influence safety culture?

10. What requirements does the context set us?

11. How to approach SC in NPP construction?

*B. What kind of behavior and what actions you want to see?*

*D. How many cultures do we need?*

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