Cost Optimization in Nuclear Power Plants

Opportunities and Limitations in the Context of Good Safety Practices

Olten, 18 November 2015

Summary of the briefing on the organizational aspects of cost optimization efforts. How can conflicting interests be resolved and unintentional changes to the culture and climate of safety be anticipated?

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Dear Participants!

The following text contains not only the things you heard about during the conference, but also additional instructive information. It is meant to enable you to return to it after the conference and read up on anything that might be relevant for your work. We are also including a list of recommended literature should you wish to pursue any topic further.

1. Shape │ Decide│ Make Sense and Speak About it

1.1. *Speaking generally…*

The two days of the conference have told you much about the greater context and conditions to be considered. You can add more of your own insights concerning the issues you heard about on slide 4.

We can distinguish different spheres, stakeholder groups, and organizational types in the environment of an organization [1]. International organizations are at work in many different markets, and they are confronted with many increasingly complex and obscure processes running parallel. The actors in the many markets are watching each other closes.

Management decides what the organization, as a whole, should respond to. This decisions depends strongly on how relevant managers consider a piece of information received from the environment and on how they interpret it. Communicating is difficult in this area. The eventual decisions should motivate the stakeholders to trust the organization, and they should guide and align the executives and employees of the organization. Management decisions also have another purpose: Impressing the other actors in the market.

For nuclear power plants in particular, we must not underestimate how important

knowledge is as a resource. Knowledge is mined by actively maintaining relationships with other functional systems in society, like science or politics. When the people on the ground have doubts about or are disappointed by their managers' decisions, frustration is likely to follow.

Not all stakeholders' expectations can be fulfilled in every case. Sometimes, they will have to be disappointed. High reliability in terms of constantly safety-conscious practices must not be compromised. We need to remember that the sources of decisions and the actual decisions will not become social reality unless people are communicating about them. The conflict between efficiency and care comes into play when we are speaking about cost reductions, and we need to talk about it. Employees know their everyday routines very well and should understand the rationale of management decisions about specific issues, and they should be able to contribute their views. Once decisions have been taken and their implementation has been planned, managers have a right to expect that the decisions are indeed implemented. It is up to line managers to become the bridge between executive management and the workforce at large. If communication is missing or ambiguous, it is very likely that the employees will fill frustrated, causing many pointless debates and costing time and money that no accountant could calculate correctly. Managers would do well to put in place the right conditions for people to stay motivated and commitment to work. Communication is the be-all and end-all of good management.

1.2. …and for nuclear power


In nuclear power plants, professionalism, competence, and reliability are paramount. They come into action whenever the many uncertainties of everyday work need to be balanced, juggled, and grappled with. Not all of these uncertainties can be

anticipated or prepare for. That is why genuine resilience, as expressed in reliable technology and resilient routines, matter. Technology and procedures (including guidelines, processes, rules etc.) cannot, however, protect us from everything the future might bring. We need to stay responsive and adjust flexibly to the circumstances we find ourselves in. We need to understand the difference between resilient technology, procedures etc. and dynamic adaptation: What should be adapted or made flexible? How much leeway should be allowed for professionalism to stay possible? These questions have inherent contradictions, and communication – speaking about them and, if need be, rethinking decisions – is key.

People are flexible by nature, but they need to be given behavioural options that they can recall and activate when the unexpected or unplanned occurs. Practicing (also mentally) responses to challenging incidents or crisis scenarios is part of this, because little security can be gained from something that was not practised and cannot be recalled.

When these precautions are used, and always updated in nuclear power plants, we should manage to display genuine resilience if the worst comes to the worst.
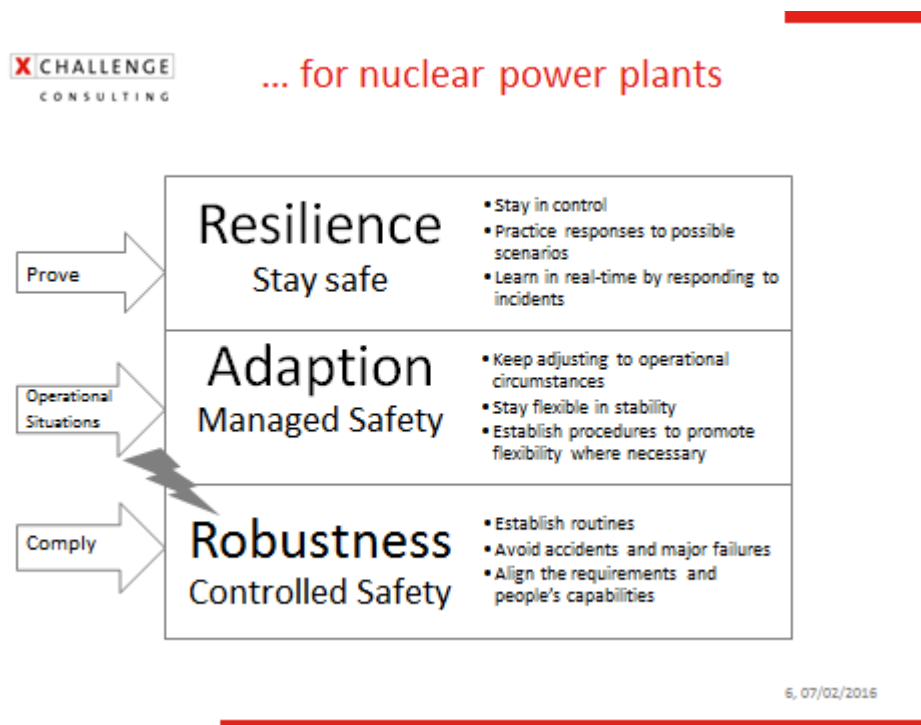
The Federal Civil Protection Agency BABS considers nuclear power plants part of Switzerland's critical infrastructure and has declared resilience a key aspect. It is up to the organizations to decide which challenging incidents need to be anticipated and prepared for, and which will not be prepared for. The art of successful safety interventions consists in balancing the compromises and conflicts of interest between the gains of controlled safety and the resulting losses in terms of situational safety practices [2].

1.3. *Good Safety Cultures and Climates*

Cultures of Safety

The concept of this conference stops us from challenging the idea of maintaining a good culture of safety or a good safety climate. Its purpose should be evident when we understand what we mean by these terms. For reasons of brevity, the slide only includes a few selected aspects:

Definition By Edgar H., Schein [3]:

"Culture is best thought of as what a group has learned throughout its own history in solving its problems of external survival and internal integration. It is best conceptualized at its core as the shared, tacit assumptions that have come to be taken for granted and that determine the members" daily behaviour." … [3] "For purposes of understanding safety, it is my contention that we must look at both basic assumptions, the skeleton in each group's culture in terms of deep beliefs and assumptions about the importance of life and health, and the more surface contingencies that define immediate behaviour'"

Edgar H. Schein [3] draws the following conclusion: "… all task performance is subject to operators discovering new things - better ways to do things, shortcuts, unanticipated safety factors, what Snook [4] has so usefully labelled 'practical drift'" … "I believe we have to accept such practical drift as being inevitable in all operations, have to observe it, have to analyse it, and have to decide how best to integrate it into our safety programs."

A culture of safety in this sense is not a one-time achievement that will stay in place once it has been achieved. According to Gudela Grote [5], the key criteria for a good culture of safety are the norms and assumptions that govern our behaviour and that support a correct balance between stability and flexibility. All aspects that affect stability and flexibility are relevant for us, as they contribute to reinforcing,

weakening, or even contravening the culture of safety. Every organization that needs to avoid accidents or major failures will develop a unique culture of safety. It cannot be compared or copied from one organization to the next. The established culture of safety can be a source for resistance to change, and it cannot be imposed or managed from above. It can help anticipate developments that might come true, but it cannot be used as an ex-post-facto explanation for something that has already happened.

Climates of safety
A climate of safety represents the shared perceptions and assumptions about the reality of the organization [5]. These perceptions and assumptions can encourage us to rethink the safety culture we have in place.

2. Possible tensions and conflicts

2.1. *All tensions and conflicts have a social context*

This image tells us a lot about how we handle conflicts and how different perspectives are at work in communication. All conflict and all perspectives have a specific social context.

Most management research is based on the theoretical assumption (scientific rationality) that the difference between subject and object is the basis for our relationship with the world and acquisition of new knowledge. The logics of practice were constituted with this epistemological assumption of a difference between the subject and object. Research is assumed to be objective, theories are formed, and people assume that practitioners only need to have and use enough theoretical knowledge to produce the results they expect. The basic assumptions have only begun to be challenged when people started to notice that the expected results tend to not materialize.

Our basic assumption is that people, as subjects, are always caught up in their world and the social practices and meanings that are established in it (social structure), constituting the logics of practice for them. When a person practices a certain social practice, he or she internalizes it as an automatism or subconscious routine. Such "embodied" skills mean that routines are executed in the specific context of a specific incident (time, event, social setting etc.) – whereas scientific rationale tries to make universal statements or provide universal solutions that work or are true in any context. At the same time, people's actions anticipate potential events and the options they have in then. People are always one step ahead of themselves in their actions. Research on HRO (High Reliability Organizing) [6] has revealed how people can use such internalized routines effectively. As this is very important for a culture

and climate of safety and for the right way to cope with ambiguity in communication, we will give a brief overview of the 5 HRO principles:

2.1.1. **Preoccupation with failure:** Even though the ideal state would be the complete avoidance of errors, mistakes, and failures, failure will always be an option. The principle reminds us that mistakes can occur and to be able to notice deviations as soon as possible. Such deviations need to be monitored to see how they develop (keeping one "preoccupied" with them) and to be able to stop them effectively before they cause an avalanche of other failures (cf. principle 3) that cannot be stopped in its tracks anymore [7].

2.1.2. **Reluctance about simple interpretations:** Many things in organizations are taken for granted because a certain reading or interpretation has become ingrained. It does not help to constantly challenge everything, but a certain doubt and reflective experience protects the members of an organization from the arrogance or ignorance of assuming that everything is safe and sound.

2.1.3. **Sensitivity to operations:** This principle recalls the sensitivity, but also the great competence that is needed to recognize the tiny differences in systems with their unexpected and unpredictable interactions and to respond immediately to them. By contrast to the first principle's preoccupation with failure, the focus lies on not noticing and tracking individual instances of deviation, but on understanding the system and the dynamics at work in it at any given moment.

2.1.4. **Pursuit of flexibility:** There is no perfection. No flawlessness. No fault-free work. And no person above erring. Karl E. Weick and Kathleen Sutcliffe [6] are very clear about this basic point. When something unexpected happens, an appropriate response is needed to keep the possible damage to a minimum. This includes not just the flexible, situationally appropriate provision of the right resources and knowhow, but also the ability to stay in control of developments – not least on the emotional level. Not allowing fears and emotions to run rampant, staying ready for decisions and for action might be easier said than done; it requires trust in oneself and in one's abilities just as much as in those of the people around oneself.

2.1.5. **Respect for expertise and competence:** A prominent place in a hierarchy does not necessarily go hand in hand with the presence of substantial expertise or knowledge. In emergencies in particular, it is important to know where expertise is stored (lower down in the hierarchy or even outside the organization) for it to be used immediately and at the right place. Experts involved as advisors, however, neither solve problems nor take decisions. The responsibilities of all involved parties need to be known to avoid a diffusion of responsibilities. Trust in and familiarity with [8] people and their professional abilities, experience, and the authority to take decisions and act in the given situation are the key to avoiding power games and disputes over authority in such instances.

2.2. Possible conflicts

We need to understand the frictions and tensions that exist in nuclear power plants. In part 1, we discussed why it matters to know the environment of the organization in question. It should be understood that we should know our own teams even better.

2.3. Understanding the conflicts

Tension 'does something' to people. According to René Amalberti, the three most important dimensions in which we need to compromise and reconcile matters [2]

- The lifecycle of the organization
  The pressure for increased safety is greatest in the latter stages of the lifecycle, when margins are eroding and costs are increasing.
- Operators
  If operators are expected to play a key role in managing safety, four safety-relevant aspects should be prioritized:
  o In any case, failures do not count, but failed recoveries;
  o Workplaces should be arranged to be intuitively understandable without mobilizing too many cognitive resources. Enough of the attention span should be left for aspects that concern safety: Anticipation, strategic orientation, options, and decisions;
  o Recovery strategies are prioritized for the least safe system; training and incident analyses and people's involvement in the definition of procedures must not be limited;
  o A set of standards and restrictions is defined for the safer systems to match how the organization is expected to perform.

- The rules need to be known at the grass root level to avoid potential unexpected conflicts of interests (cf. part. 3)

2.4. The ETTO Principle
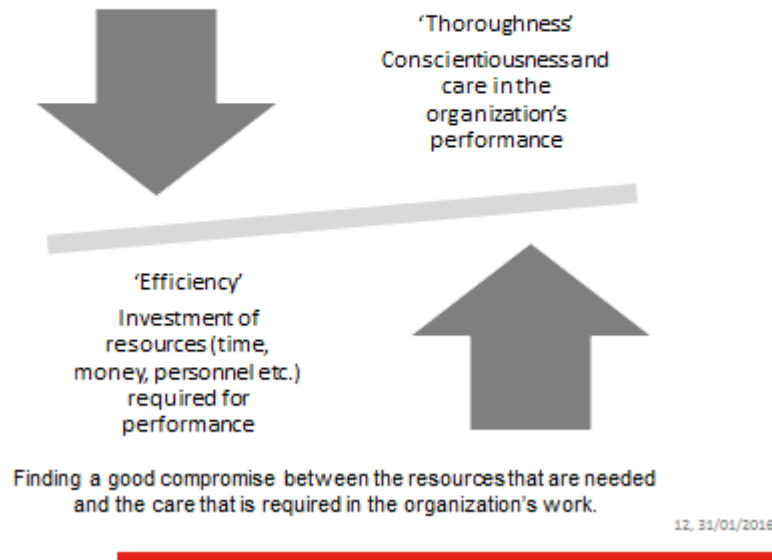The ETTO principle can help make reliably good observations and decisions:

The ETTO principle is part of the resilience engineering of Erik Hollnagel [9]. It describes the tension between efficiency and the conscientious and careful execution of tasks. The first would imply that as little time and as few resources as possible are used, whereas the latter needs lots of time and professional skill. To understand this tension at work, it helps to explore possible conflicts of interest, before taking a decision about what should be optimized and how this should be done. This is a tough call, which deserves care and attention.

The ETTO Principle

'Thoroughness'
Conscientiousness and care in the organization's performance

'Efficiency'
Investment of resources (time, money, personnel etc.) required for performance

Finding a good compromise between the resources that are needed and the care that is required in the organization's work.

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Efficiency demands the greatest possible outcome with the least possible input, which can run counter to time-intensive care and conscientiousness.

One particular thing to note here is the drift into danger that needs to be avoided and monitored carefully. Barry Kirwan & Andrew Hale [3] are outspoken about their concern that economic pressure is slowly eroding the resources invested for safety purposes. This happens because erosion usually starts unnoticed (tiny changes not witnessed by anybody), and nothing major happens for a long time – until something major happens. Regular monitoring of safety-relevant activities can help anticipate or recognize the drift into danger.

3. *Managing and reconciling the conflicts*

3.1. *Requirements*

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Managing and reconciling conflicts

Requirements
- A list of questions is defined for the identified tensions and issues affected by them
- Remaining ready, open-minded, and interest in different viewpoints
- Maintaining mastery despite many technical solutions and procedures being available
- Maintaining a culture of safety that allows controversy

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These conditions are necessary for us to cope with the tensions at work, across organizational, disciplinary, or hierarchical boundaries. Opinions can differ, but relationships must not suffer from such conflicts. Trust is the key ingredient.
It is an uphill struggle to maintain professional competence (mastery) if many aspects are handled by technical solutions. We do not want to imply that technical solutions should be rejected. Rather, the key is their scope and complexity, which tends to increase in technical procedures and affect the remaining part of non-technical solutions. These are also becoming more complex, else a technical solution would have already been found.

3.2. Structures, processes and contents

We suggest a link between management and operations, a forum for learning and sharing with a fixed structural place. For the purposes of this conference, we call this forum: MOL. As mentioned, we will begin by writing a list of questions on relevant tension areas. Only when we know the extent and scope of his list can we begin a first action cycle by deciding

- How often, and
- With which data and at which points the MOL is conducted,
- Who takes part and/or hosts it,
- And which questions are answered and which decisions are taken in which instances.

Invitations should be sent out in good time, including the proposed agenda, timing, and preparation assignments. The MOL itself is an iterative process:
a. Explaining the question to be discussed
b. Defining which issues and aspects concern this question
c. Explaining the (pre-prepared) information
d. Discussing the available information. Is anything missing? Who will procure what by when? (See the details on the next two slides)
e. Prioritizing the information
f. Drawing conclusions from the prioritized information
g. Assessing whether the conclusions are affecting the safety culture too severely and whether they actually promise cost reductions
h. Planning activities (Who, what, by when, with what, and for which purpose)
i. Reviewing the question list (What has been completed?)

j. Should the existing list be expanded? Have any conditions changed? If so: Nominating a person or group to maintain the list and distribute it to all personnel involved
k. Recording and distributing the decisions (minutes or photographic record)
l. Sending out the next invitations
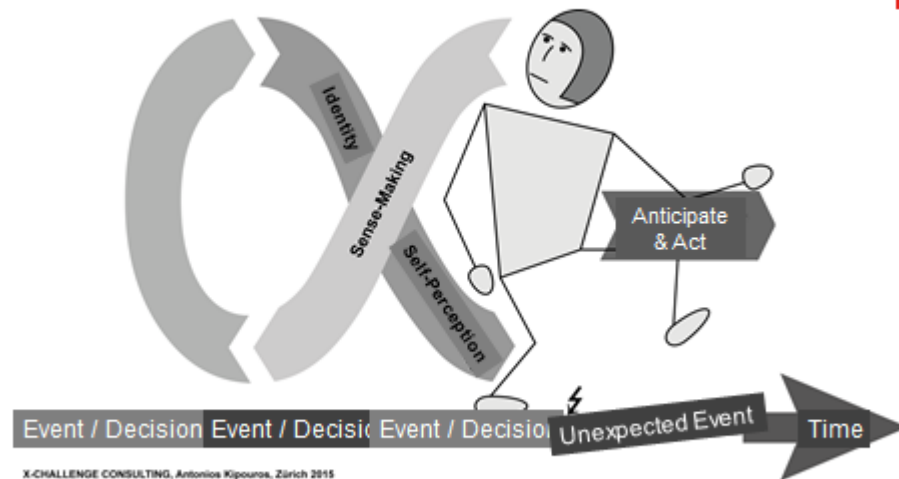
3.3. Individuals and their many rationales

Managing and reconciling conflicts

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The discussions (cf. parts. a) – g)) can give way to lots of friction and misunderstanding. One possible reason for this lies in the different rationales that people bring to communication. We can use the image of the person walking forwards, but looking backwards to explain how we need to move forwards e.g. when telling a story, but look back to interpret what we have just said. When we take a look at ourselves, we can say that we are not always moving "straight ahead", but often stray from the path. The participants in the MOL will also be coming from different professions, bringing different logical interpretations and meanings to the table. Remember the insights from part 2. Everybody involved should know and consider that misunderstandings need to be cleared up immediately. The facilitator should pay particular attention to such mix-ups and deviations and make them recognizable and manageable in the communication.

4. Conclusion

4.1. *Reducing costs comes at a cost*

Enjoy the debates – and the good decisions they lead to!

5. Recommended Reading

[1] **Rüegg-Stürm, Johannes und Grand, Simon.** *Das St. Galler Management-Modell. 4. Generation - Einführung.* Bern : Haupt, 2014.

[2] **Amalberti, René.** *Navigating Safety.* Dordrecht, Heidelberg, New York, London : Springer Dordrecht, 2013.

[3] **Swiss Re, Emerging Risk Management.** *Safety management in context - Cross-industry learning for theory and practice.* Zurich : Swiss Re, 2013.

[4] **Snook, S. A.** *Friendly Fire.* Princeton, NJ. : Princeton Univ. Press, 2000.

[5] **Grote, Gudela.** http://www.ntsb.gov/. [Online] 9 September 2013. [accessed: 20 December 2013.] http://www.ntsb.gov/news/events/2013/safetyculture/Panel%202%20Safety%20Culture/GGrote's%20presentation.pdf.

[6] **Weick, Karl E. and Sutcliffe, Kathleen M.** *Das Unerwartete managen.* 2. Stuttgart : Schäffer-Poeschel Verlag, 2010.

[7] **Weick, Karl E. and Putnam, Ted.** Organizing for Mindfulness. *Journal of Management Inquiry.* September 2006, Volume 15, No. 3, pp. 275-287.

[8] **Geramanis, Olaf and Porrini, Elvira.** Zu viel Vertrauen in Organisationen. *Persorama.* 2008, Bd. 60.

[9] **Hollnagel, Erik.** *The ETTO Principle: Efficiency-Thoroughness Trade-Off.* Farnham : Ashgate Publishing Limited, 2011.

[10] **Weick, Karl E.** *Der Prozess des Organisierens.* Frankfurt a/M : Suhrkamp Taschenbuch Verlag, 1985.

[11] **Weick, Karl E.** *Making Sense of the Organization.* Carlton, Australia : Blackwell Publishers, 2009.

[12] **Weick, Karl E. und Quinn, Robert E.** Organizational Change and Development. *Annual Reviews Psychol.* 1999, 50, pp. 361-86.