Strategic Vision and Implementation of Human and Organizational Factors in the Nuclear Industry

Kerstin Dahlgren Persson
CNSO, Vattenfall, Sweden

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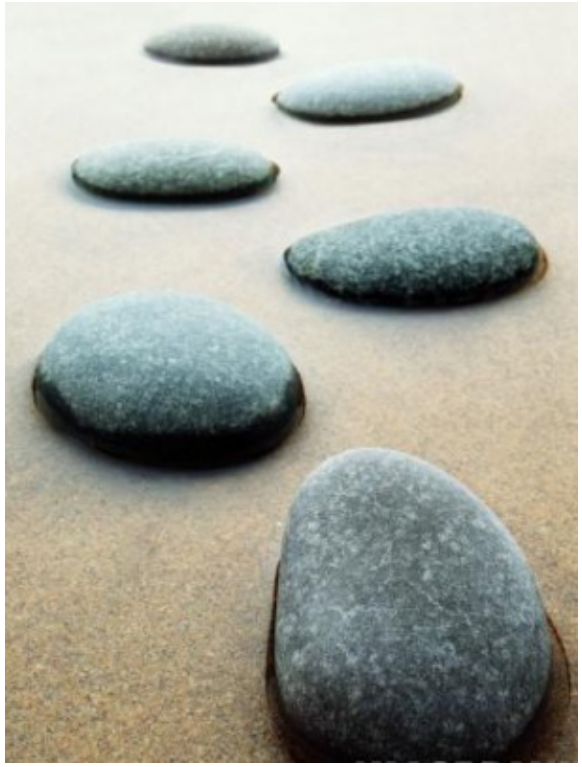

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The Fukushima Nuclear Accident Independent Investigation Commission

Message from the Chairman Mr Kurokawa:

”THE EARTHQUAKE AND TSUNAMI of March 11, 2011 were natural disasters of a magnitude that shocked the entire world. Although triggered by these cataclysmic events, the subsequent accident at the Fukushima Daiichi Nuclear Power Plant cannot be regarded as a natural disaster. *It was a profoundly manmade disaster* – that could and should have been *foreseen and prevented*. And its effects could have been mitigated by a more effective human response.” (my italics)

A very strong message and again a quest to prevent major **’systemic failures’** and focus on the dynamic interaction between individuals, technology and organizations.

A systems view of safety also in the Kemeny report of TMI

” When we say that the basic problems are people-related, we do not mean to limit this term to shortcomings of individual human beings -- although those do exist. We mean more generally that our investigation has revealed problems with the "system" that manufactures, operates, and regulates nuclear power plants.”

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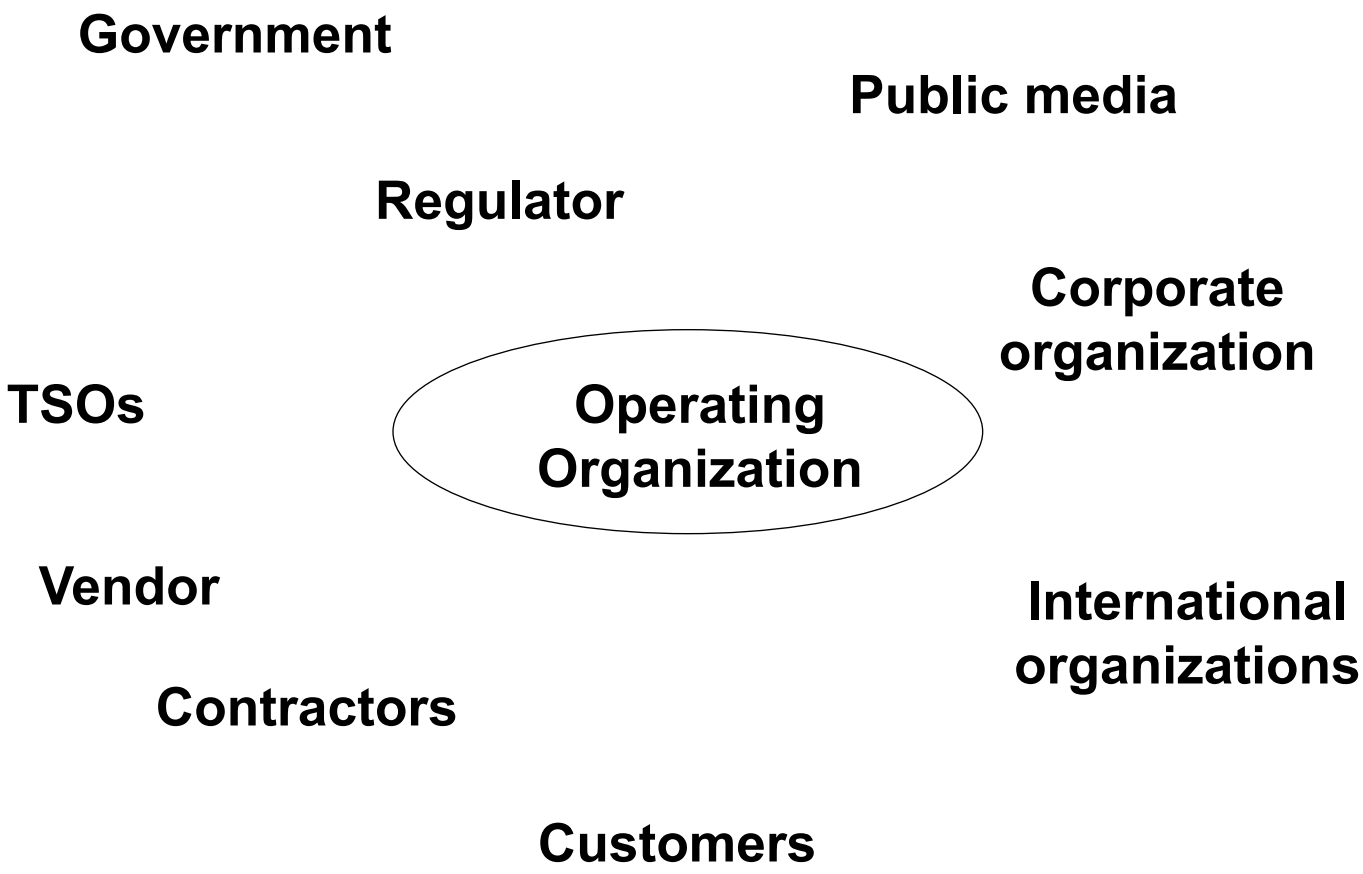
A complex and dynamic socio-technical system



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ITO – as a systems view of safety

ITO is recognizing that safety emerges from a dynamic interaction between individuals, technology and organizations

This needs and INTEGRATED approach – working with each aspect separately will not give the full picture

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What does it mean to work in an integrated way?

an example

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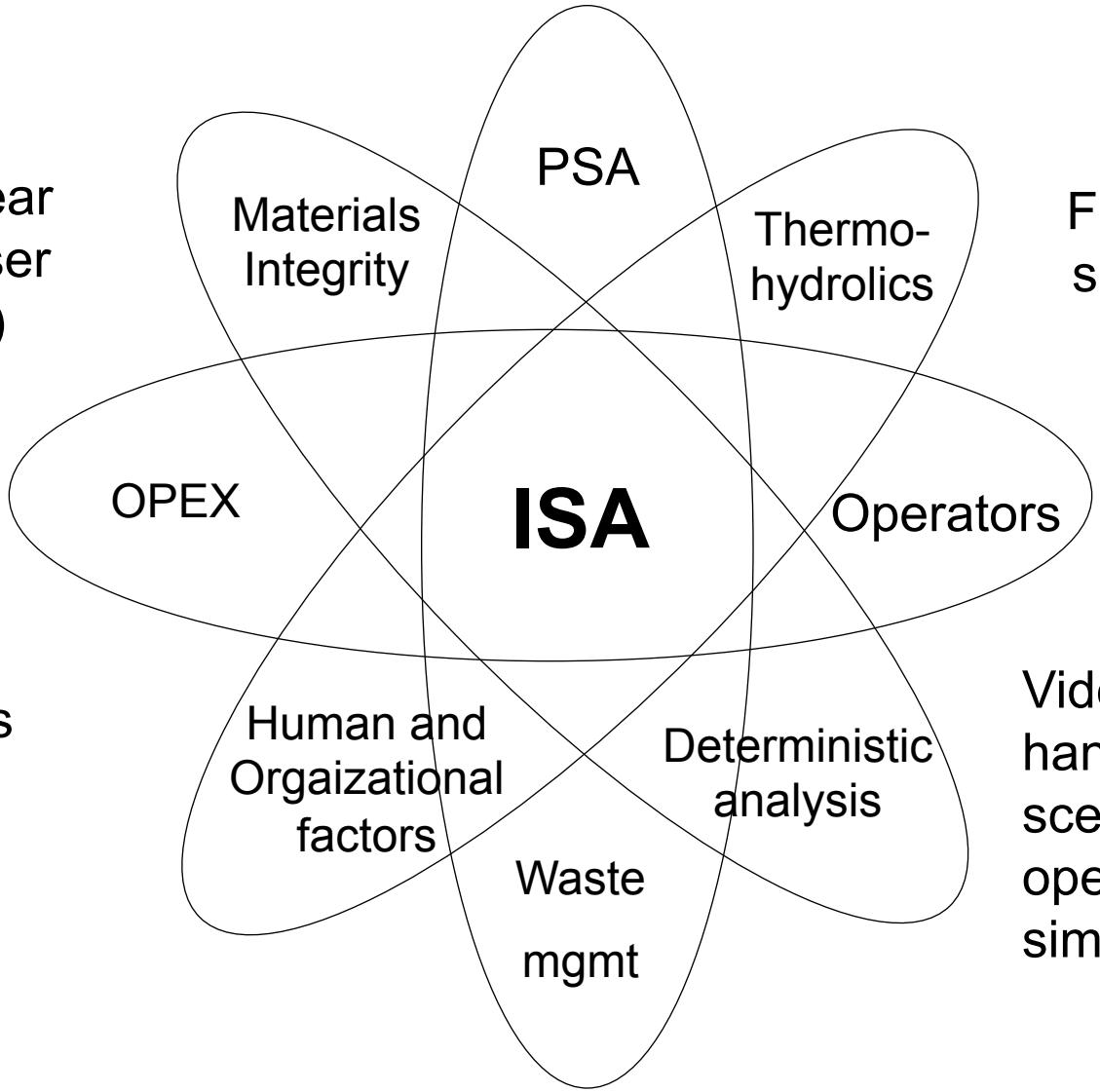
Efforts to promote a systems view at SKI- Integrated Safety Analysis - ISA

Scenario – Tube-rupture in Ringhals 2 (PWR)

NPA – Nuclear Plant Analyser (Relapp 5)



Full-scale simulator

Procedures

Video recording of handling of the scenario by operators in the simulator

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In practice, a broad range of issues to be covered in the HOF area

Just as the Technical factors require both generic and specialist knowledge so does the area of Human and Organizational Factors.

For example,

Human engineering – Human-technical system interfaces, ergonomy, considering human and organizational factors in technical plant modifications and design, V&V of instrumentation and procedures etc

Organizational issues – Leadership, management systems, organizational and safety culture etc

Competence, education and training – Proper training programs and methods, simulator training, knowledge management etc

Cognitive psychology – Desicion-making, risk perception, cognitive capacities and limitations, etc

And more ……

And various associated methodologies

What does this mean?

- You cannot have just ONE expert in Human and Organizational Factors in your organisation.
- There is a critical mass of HOF competencies needed, before you can be really useful to the organization.

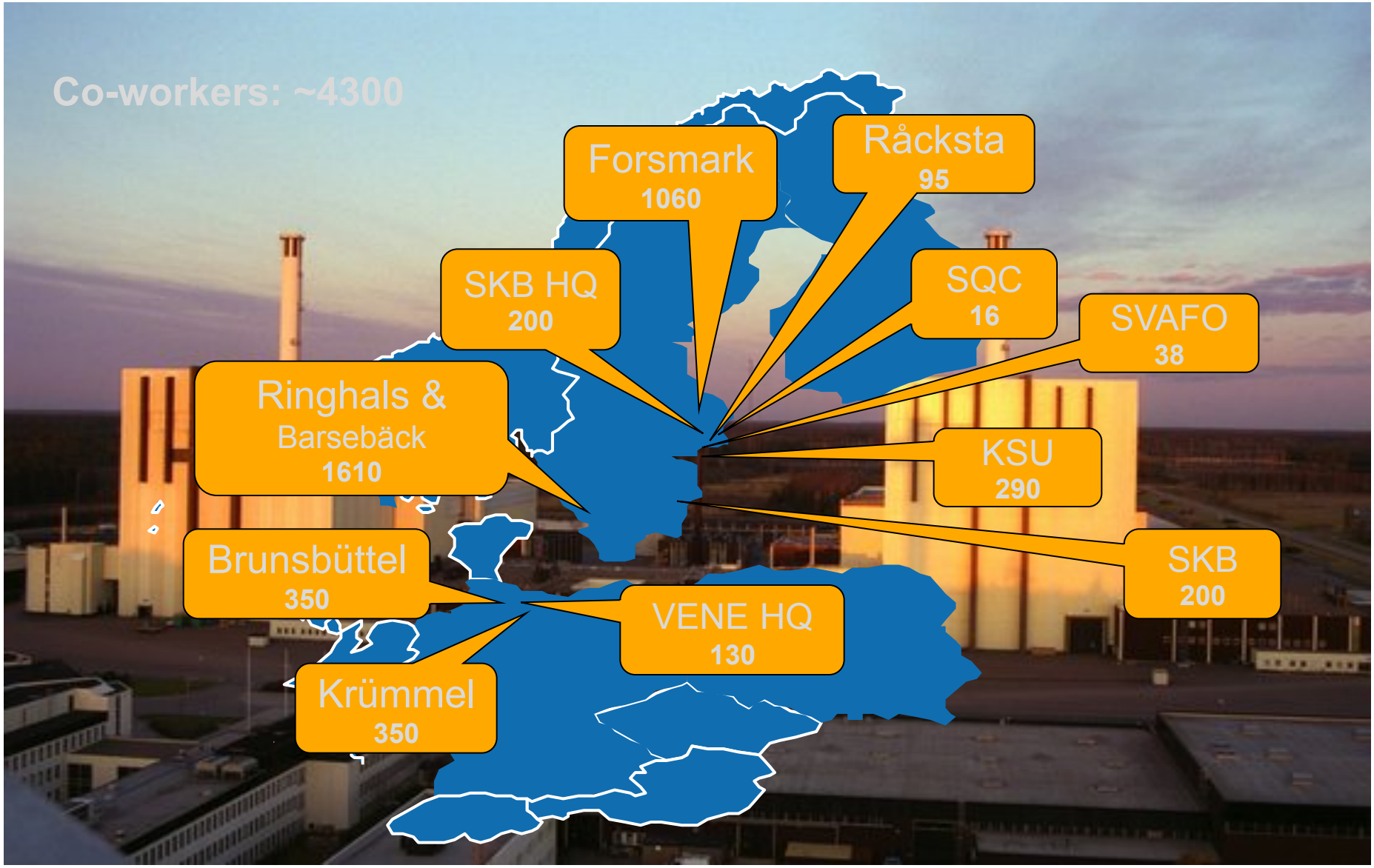
Swedish example

- After TMI a major Reactor Safety Investigation (RSU) was undertaken, upon directives from the Government.
- RSU called for an expanded view of safety so that it would include also human and organizational aspects.
- They also recommended, that the regulator (SKI) should receive enhanced resources, including 4 positions for 'man-machine' issues.
- By 1984 SKI had 3 positions for dealing with man-machine issues
- In 1985 SKI, in promoting a systems view of safety, "man-machine" was changed to Man-Technology-Organization (MTO)

Today,

- 12 experts in the behavioural and social sciences working in the Department of Reactor Safety of SSM (SKI+SSI) i.e. approximately 15% of the staff
- Equivalent experts also within the industry

Vattenfall BD Nuclear Power, Locations And Co-workers



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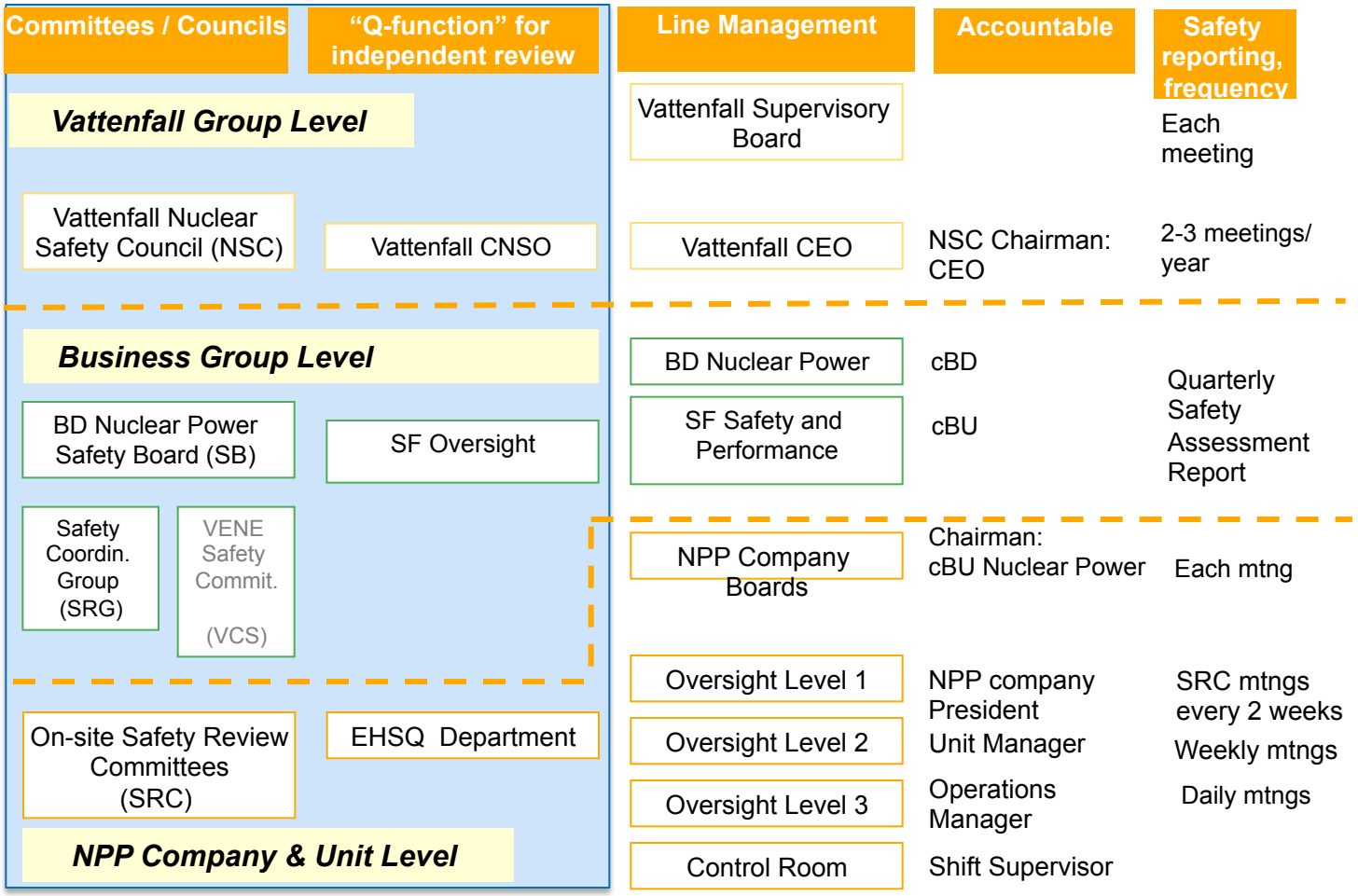
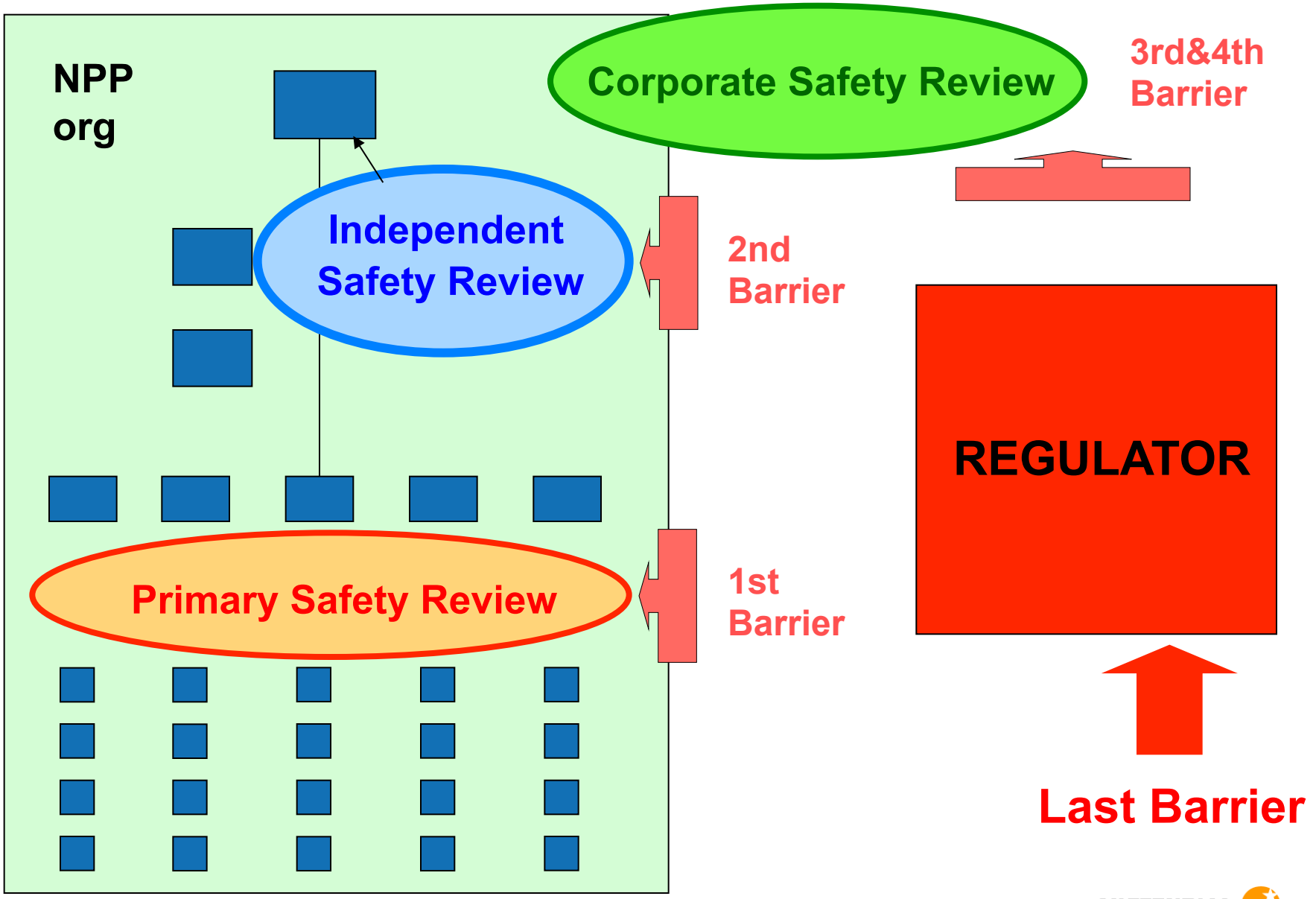
Vattenfall - Three-level approach to Nuclear Safety Governance

Nuclear Safety Governance



SAFETY REVIEW FUNCTIONS



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CNSO Proactive Safety Oversight Approach

Precursors

”Early Warning Signs”

and Strengths

IAEA 1998;2003;2009
INPO 1998;
Taylor & Rycraft 2004/11

Solutions

Expected standards

International Standards and Best Practices

- IAEA Safety Standards - Requirements and Guides
- INPO/WANO Guidelines
- Benchmarks
- Established scientific knowledge

Outcomes

Safety and Performance Outcomes

- VF KPIs
- WANO PI
- Events
- SSM reviews
- SSM injunctions
- WANO/OSART Peer-Reviews

Leading Indicators

’Input’

Lagging indicators

’output’

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Precursor Focus Areas

A. Leadership for safety
B. Management systems
C. Self-assessment processes (egenkontroll)
D. Business Environment
E. Systems view incl Long-term perspective
F. Competence incl Knowledge management
G. Organizational learning
H. Regulation

Prevention

Not only

Reactive prevention

Learning from incidents and accidents and making improvements

Also

Proactive prevention

The ability of organizations to capture and act upon developing problems (”early warning signs”), to be ”mindful”, resilient, to apply the knowledge that already exist in the HOF area and to develop strong safety cultures

Strategic Vision

Vision

A more proactive approach to nuclear safety based on a systems view

IAEA Definition of Nuclear Safety

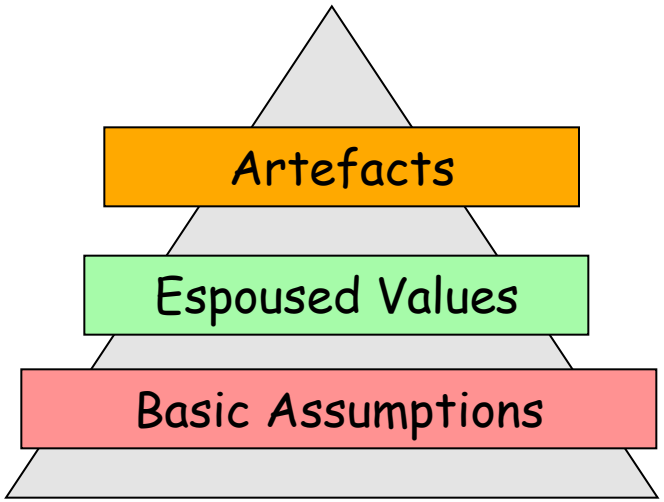
The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards

The Fukushima accident has now led to world-wide efforts to improve the technical design of NPPs as well as severe accident management i.e. strong focus on *mitigation*.

Prevention of accidents also require a proactive approach through improvements in the systemic interactions between individuals-technology-organizations and the strengthening of nuclear safety culture.

Safety Culture - assumptions

Schein's three-level model of Culture



We need to strive for safety cultures that have moved from basic assumptions like:

"A properly designed plant is inherently safe"

to

"Safety can always be improved" or "We are vulnerable – unexpected events can happen and it can happen here"

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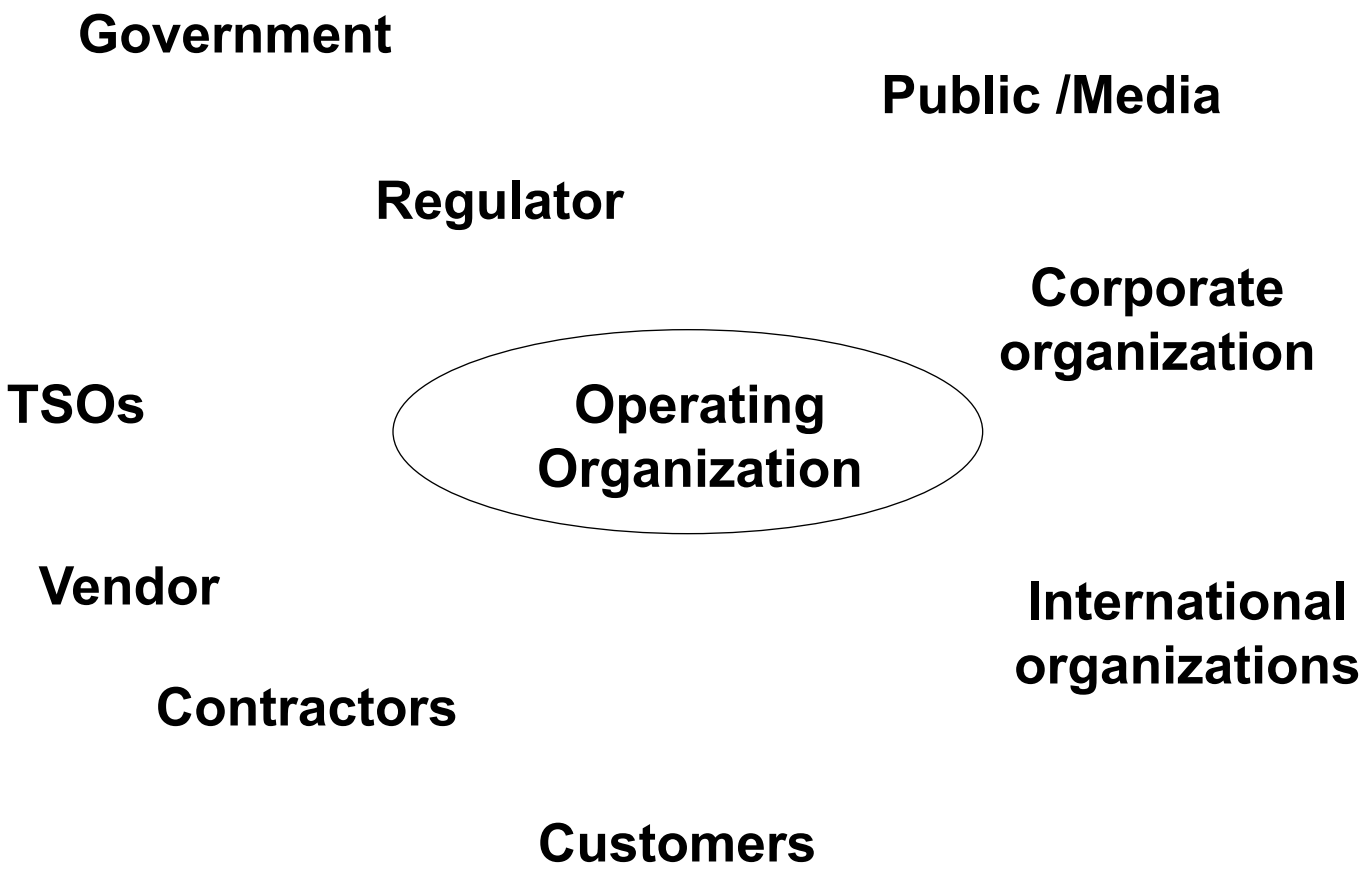
Enhancement in the socio-technical system needed



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Recommendations to IAEA

Excellent meeting!

A lot of useful information of practices and programs applied around the world illustrating how you can work with Human and Organizational Factors, ITO and Safety Culture. Should form a good basis for input to the IAEA Action Plan.

The success and sustainability of these programs will depend on the use of multi-disciplinary teams working together with an integrated systemic view of safety (ITO)

Terminology: many different words and terms used for similar practices and approaches and/ or similar words but different meanings. The IAEA may consider developing a common 'language' and definition of terms to aid communication

To make the best use of all this the knowledge around the world, the IAEA may consider the proper balance between in-house expertise in behavioural and social sciences and the contribution from external experts, in order to be able to develop proper guidance and support to Member States.

Thank You for your attention!