Managing Human, Organisation and Technology –
Achieving a Systemic Approach to Safety

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INSAG Perspective – IEM5*

"Accidents rarely happen as a result of one single event, but emerge from the accumulation of malfunctions, misunderstandings, incorrect assumptions and other issues. In the past, issues related to human and organizational factors have been addressed in the same manner as purely technical issues. Consequently, the complexity of the overall system has not always been properly taken into account. The systemic approach to safety addresses the whole system by considering the dynamic interactions within and among all relevant factors of the system — individual factors (e.g. knowledge, thoughts, decisions, actions), technical factors (e.g. technology, tools, equipment), and organizational factors (e.g. management system, organizational structure, governance, resources)."

* IEM5 = The International Expert Meeting # 5 on Human and Organizational Factors in Nuclear Safety in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant

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The Current Nuclear Safety Approach

- The common approach in nuclear safety divides the systems into smaller parts to make it manageable and to ensure nothing is left unattended – we compartmentalize
- Necessary due to the complexity of nuclear technology and its application
- Provides robustness for most predicted and unpredicted situations.

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- The common approach in nuclear safety divides the systems into smaller parts to make it manageable and to ensure nothing is left unattended – we compartmentalize
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BUT…

- Working with each aspect separately does not give the full picture of the system
- Tends to overemphasise technical factors – a strong belief that if the technology works, the plant is safe
- A systemic approach to safety complement the current safety approach

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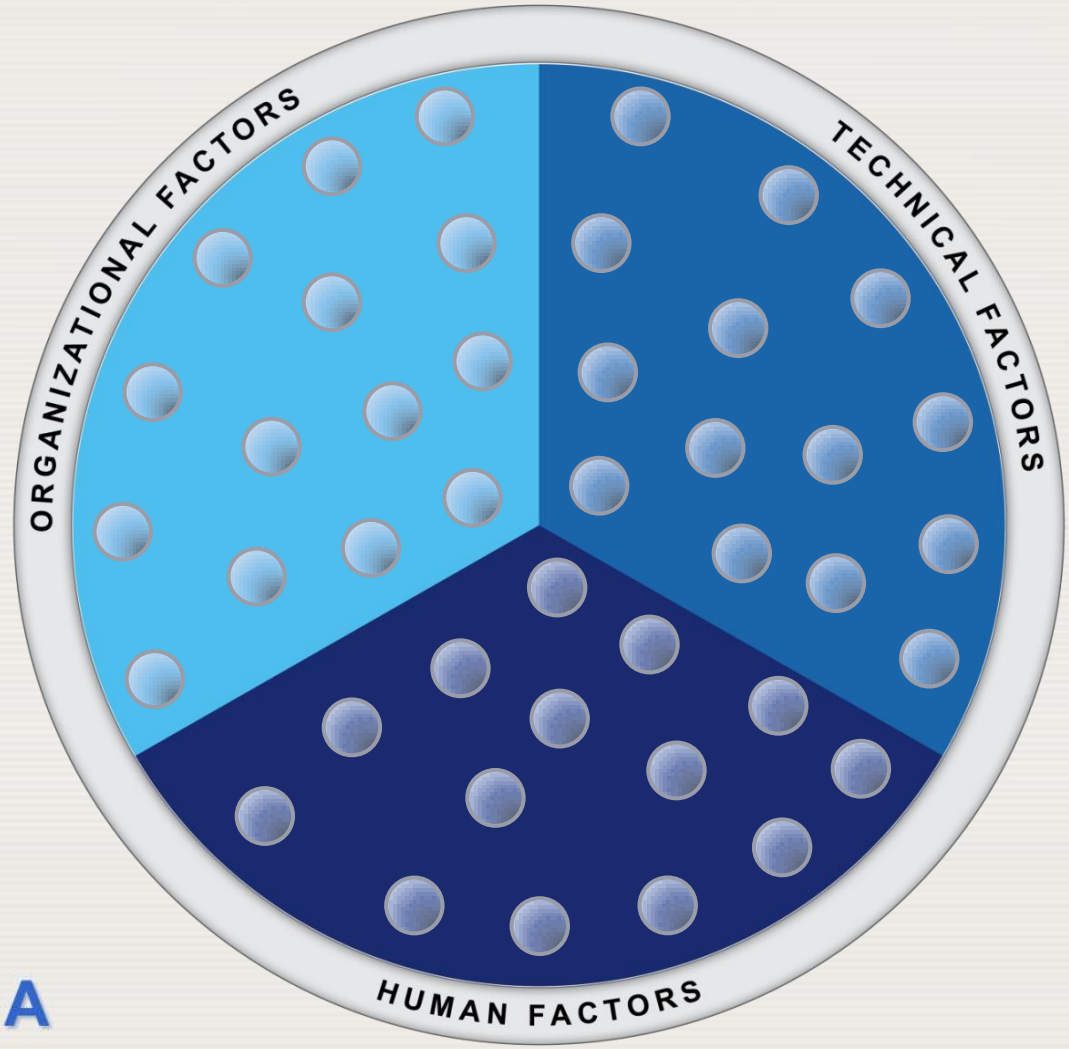
Human, Technical and Organizational Factors



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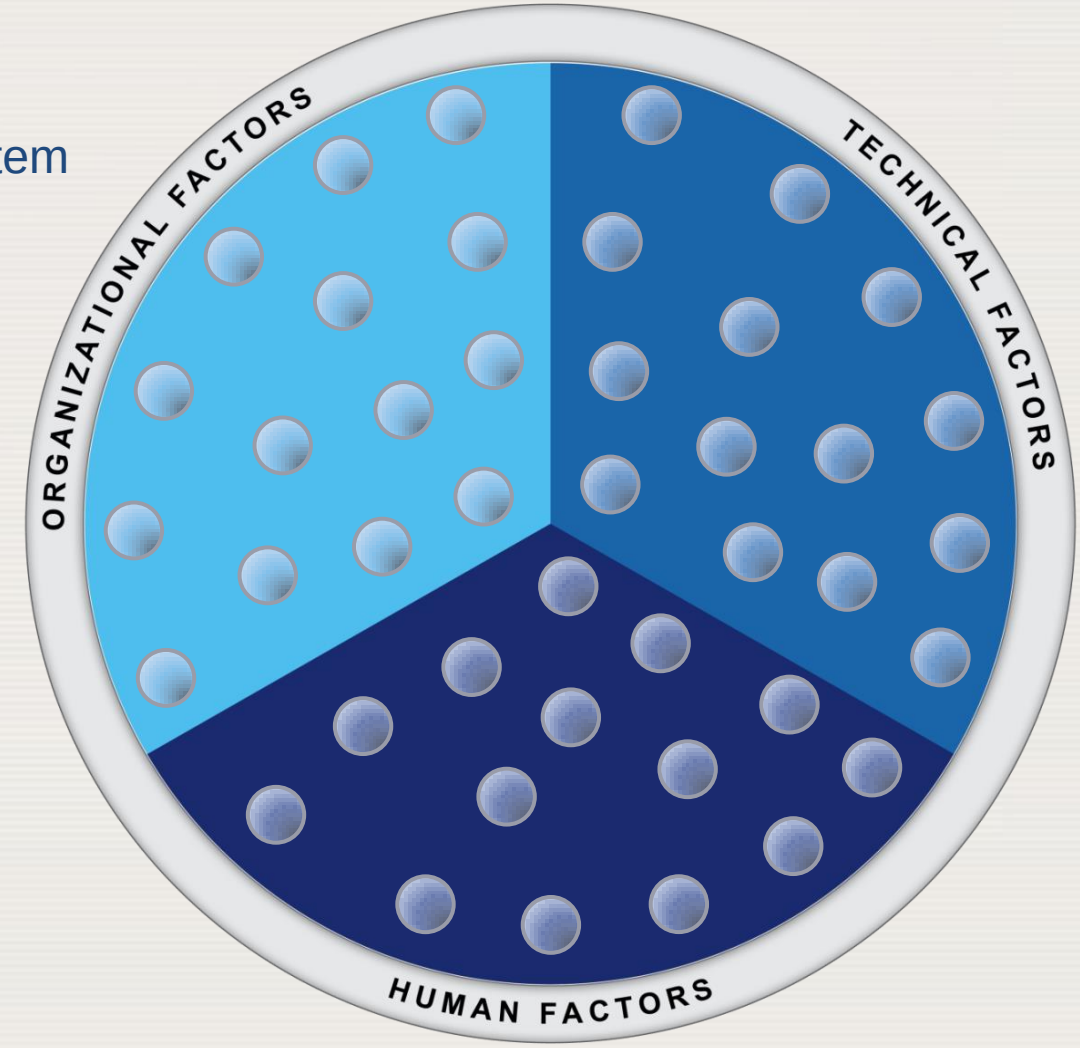
Examples of Organizational Factors

Organizational Factors (OF):

- Vision and objectives
- Strategies
- Business Models
- Integrated Management System
- Continuous improvements
- Decision making process
- Knowledge management
- Priorities
- Communication
- Contracting
- Work environment
- Culture
- etc



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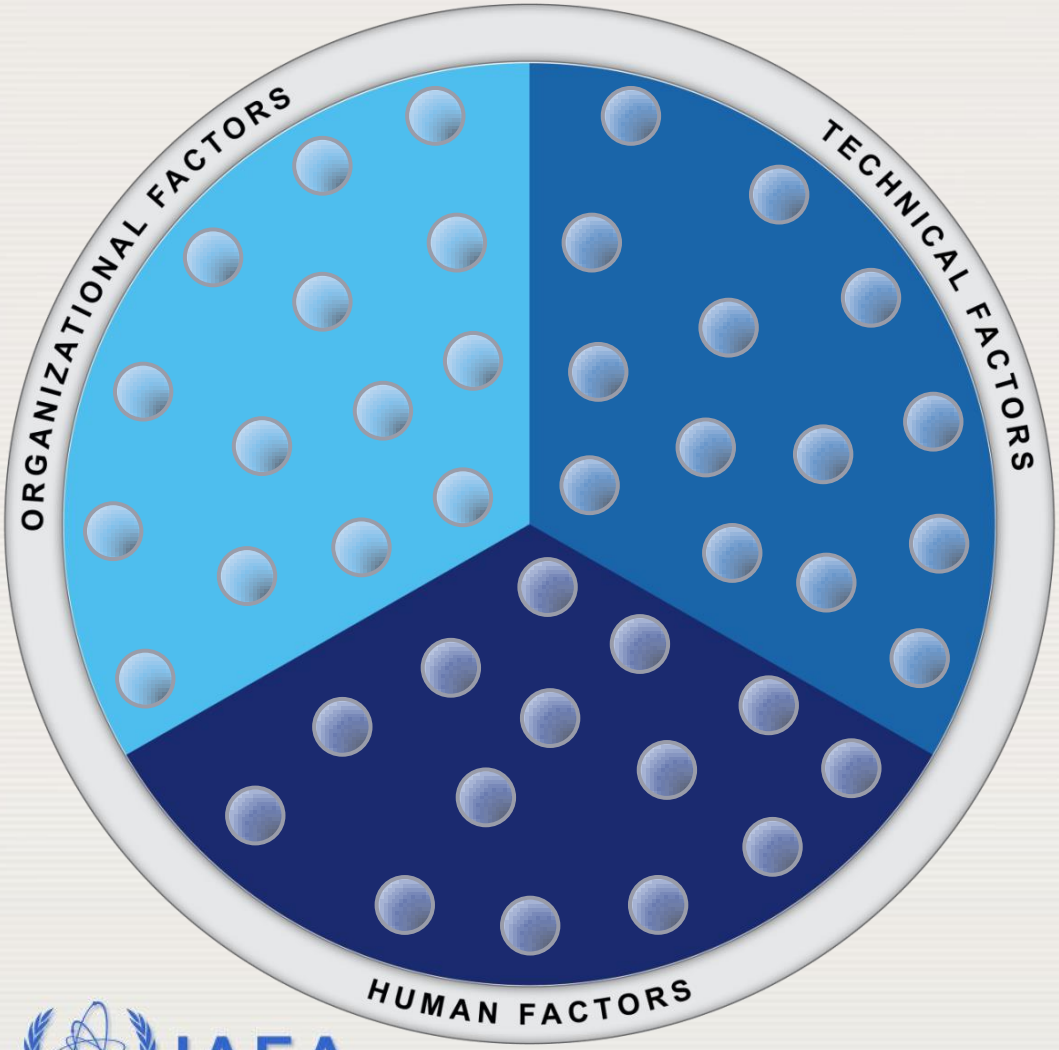
Examples of Technical Factors



Technical Factors (TF):

- Design
- Existing technology
- Hard ware/Soft ware
- PSA/DSA
- Technical Specifications
- I/C
- Quality of material
- Equipment
- etc

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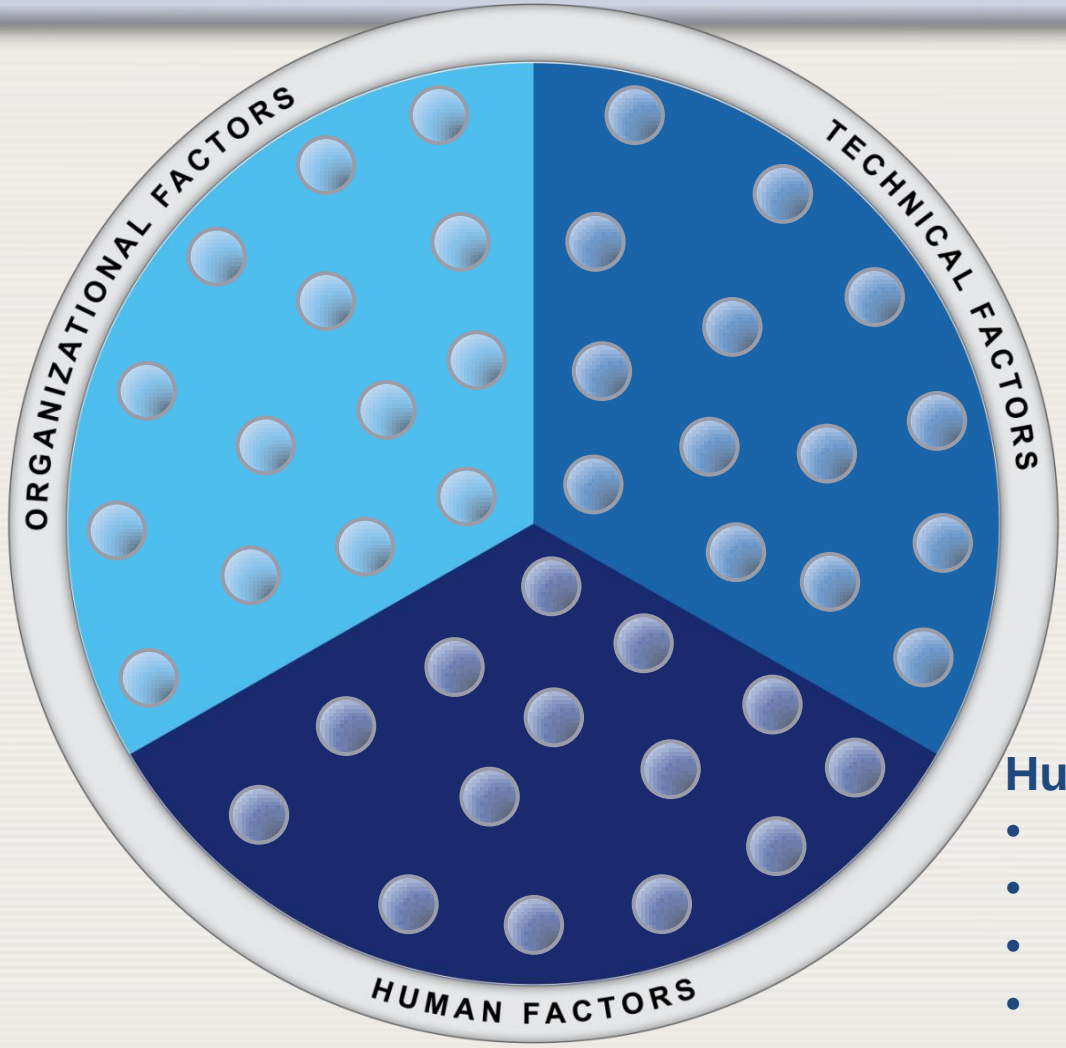
Examples of Human Factors



Human Factors (HF):

- Human capabilities
- Human constraints
- Perceived work environment
- Motivation
- Individuals understanding
- Emotions
- etc

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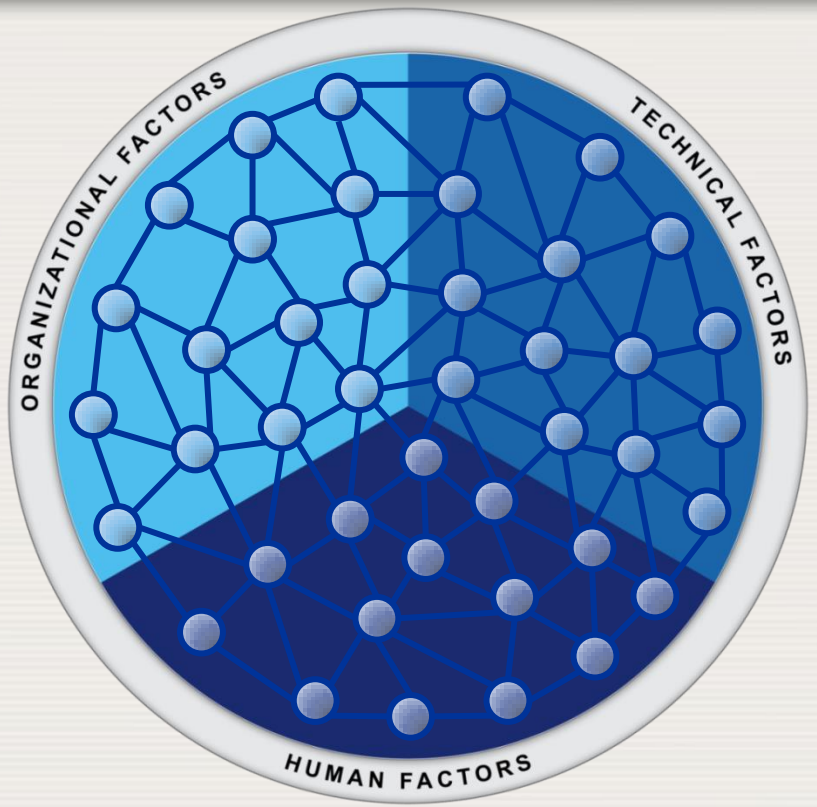
The Interaction Between Human, Organizational & Technical Factors - Systemic Approach to Safety



Pays attention to:

- Interactions (space between factors)
- Dynamics (non linearity)
- On-going (non stability)
- Complexity (multi dimensionality)

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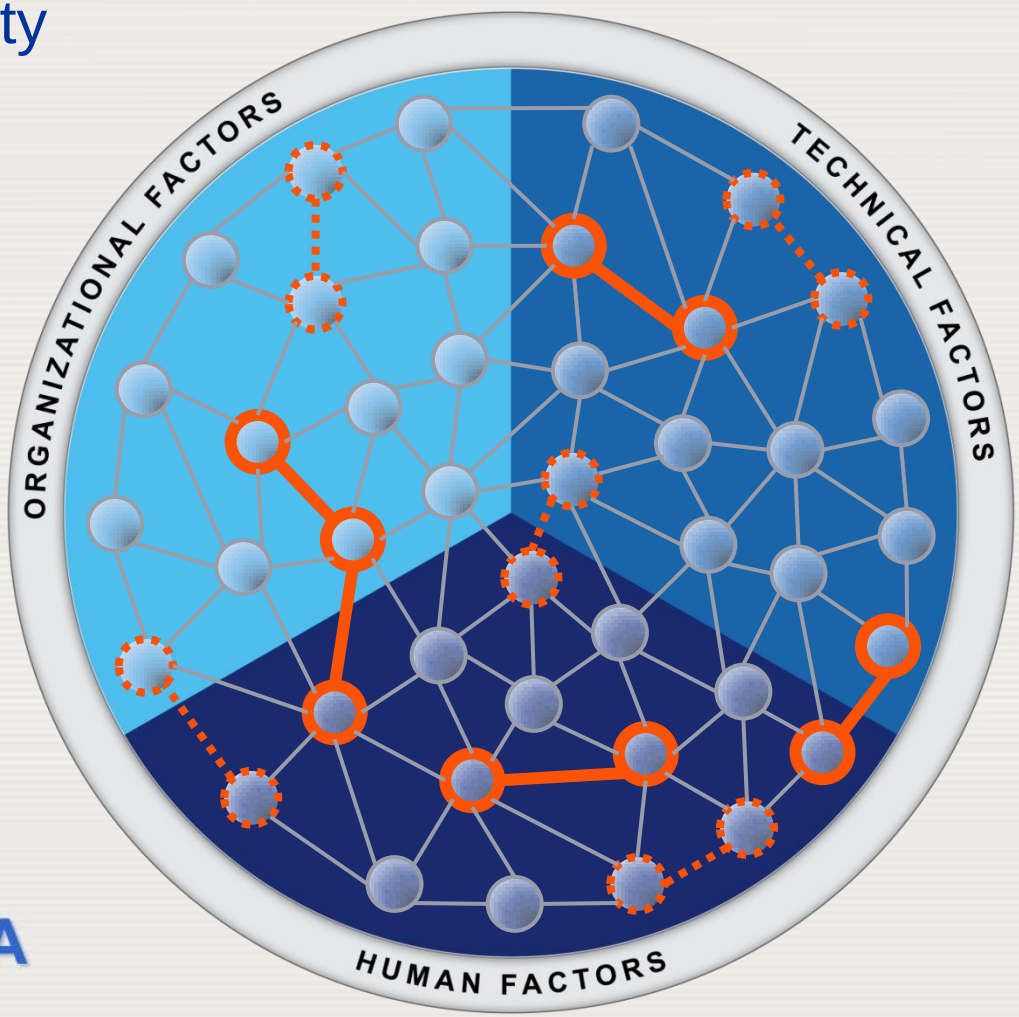
“A system is only as strong as its weakest link”

The systemic approach to safety capitalizes on understanding the strengths as well as the vulnerabilities in all factors influencing nuclear safety



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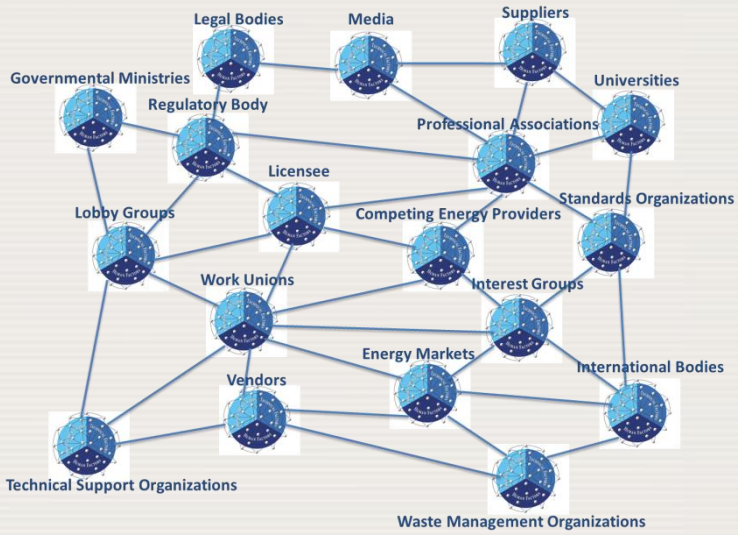
The bigger picture



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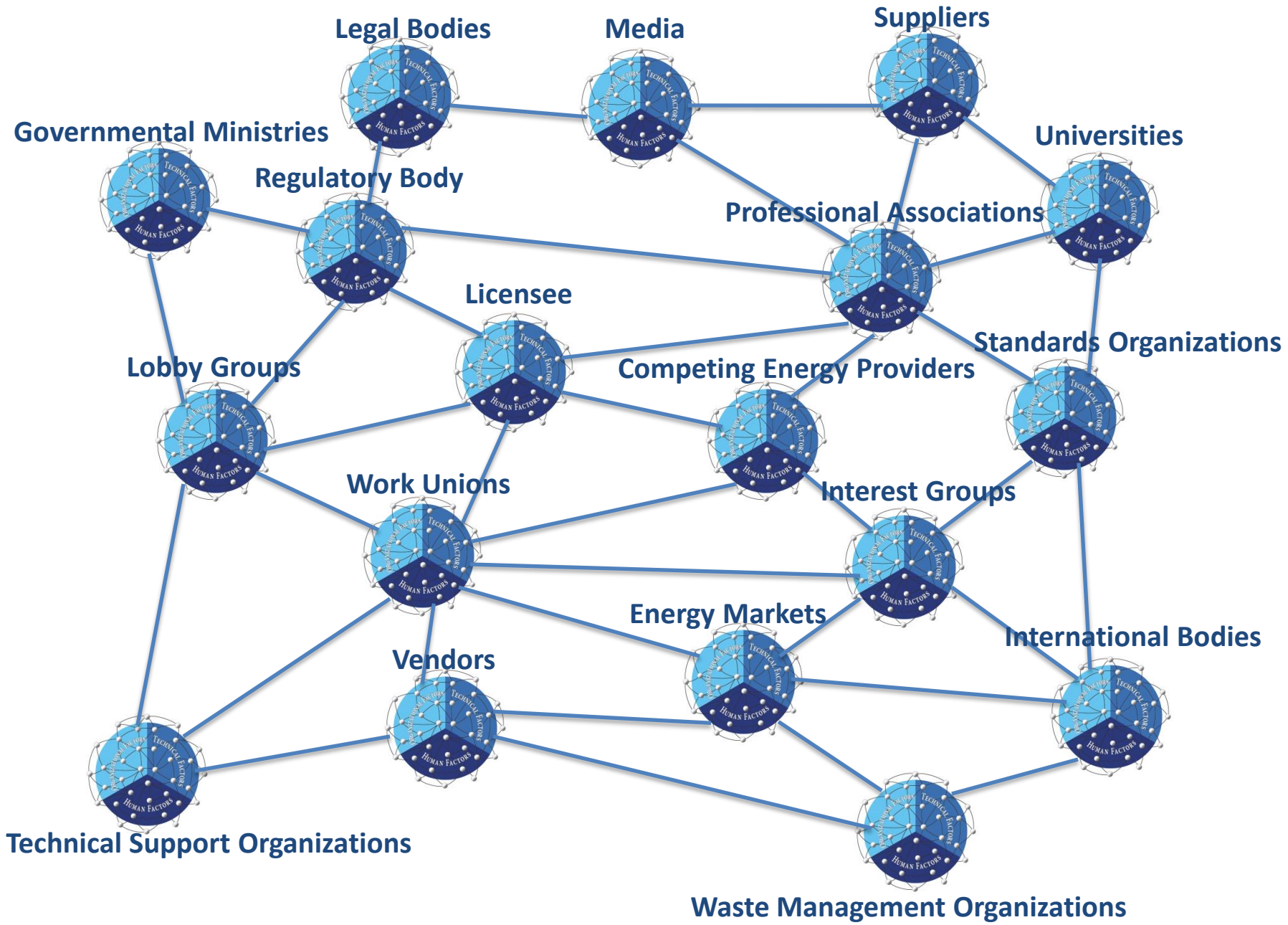
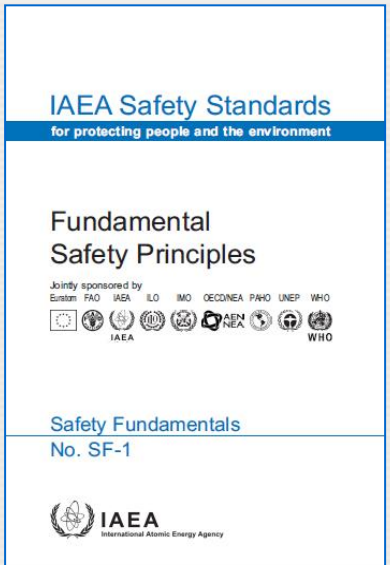
Systemic View of Interactions between Organizations



Fundamental Safety Principles SF-1

The Interaction between human, technology and the organization - HTO

3.14. *"An important factor in a management system is the recognition of the entire range of **interactions** of **individuals** at all levels with **technology** and with **organizations**. To prevent human and organizational failures, human factors have to be taken into account and good performance and good practices have to be supported."*



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Safety Standard GS-G-3.5

The Interaction between human, technology and the organization

- 2.32.”*All safety barriers are designed, constructed, strengthened, breached or eroded by the action or inaction of individuals. Human factors in the organization are critical for safe operation and they should not be separated from technical aspects.* ***Ultimately, safety results from the interaction of individuals with technology and with the organization****.”*
- 2.33. ”*The concept of* ***safety culture embraces this integration*** *of individuals and technical aspects.*

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Safety Standard GS-G-3.5

The Interaction between human, technology and the organization

- 2.34. "*In a strong safety culture, there should be a **knowledge and understanding** of human behaviour mechanisms and established human factor principles should be applied **to ensure the outcomes for safety** of individuals–technology–organization interactions. This could be achieved by **including experts on human factors in all relevant activities and teams.**"*

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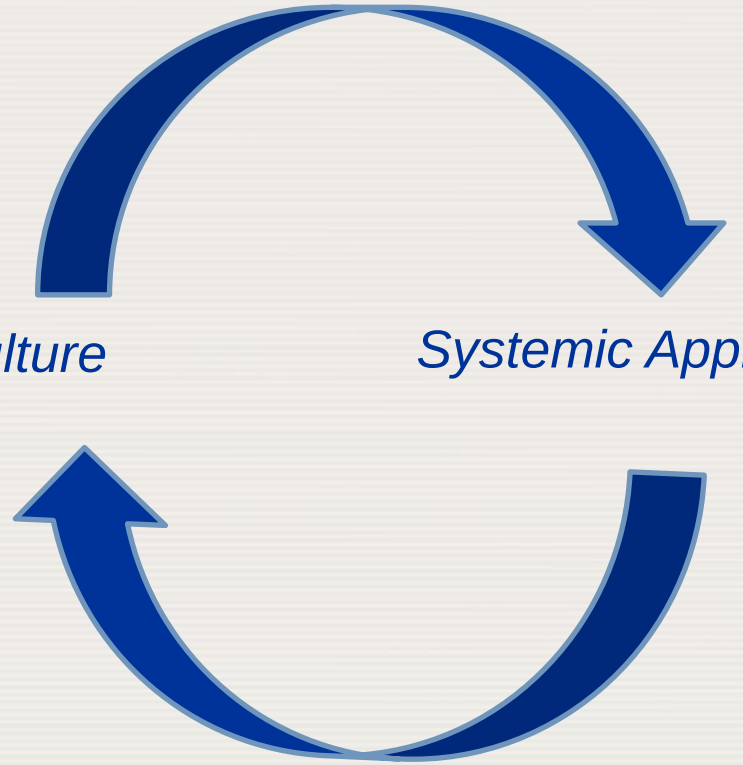
Safety Culture vs HTO Systemic Approach



Strong safety culture

Systemic Approach - HTO

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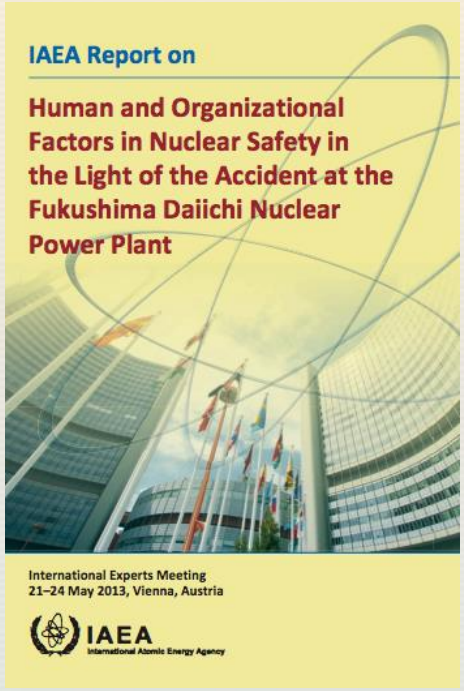
A Nuclear Safety Action Plan activity

International Experts Meeting (IEM5)

on

Human and Organizational Factors in Nuclear Safety in the Light of the Accident at the Fukushima Daiichi NPP

Vienna, 21 – 24 May 2013



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IEM5: Lessons learned – HTO/Systemic Approach

- The **discrete** human and organizational factors are important, but not enough – their **interactions** with the technology needs also to be taken into account (HTO/Systemic Approach)

- HTO/Systemic Approach to Safety on **organizational level** (encompass the human and organizational interdependencies with the technology within the organization)

- HTO/Systemic Approach to Safety on **national level (**encompass how different organizations/groups influence each other, e. g. governments, regulatory bodies, licensees, public, TSOs)

- The need to involve **social and behavioural science** expertise to comprehend and apply a systemic approach to safety as well as in the continuous improvement work in safety culture

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How to Manage and Proactively Improve HTO

On a human, organizational and cultural level it comes down to how we work together within and between the teams, organizations and nations to achieve safety as the paramount priority to protect people and environment. It is the level of collaboration and how we are interacting that will qualify and determine the success. In short, how able we are to effectively:

- *Communicate*
- *Share information, experiences, knowledge*
- *Learn*
- *Implement*
- *Assess and review*

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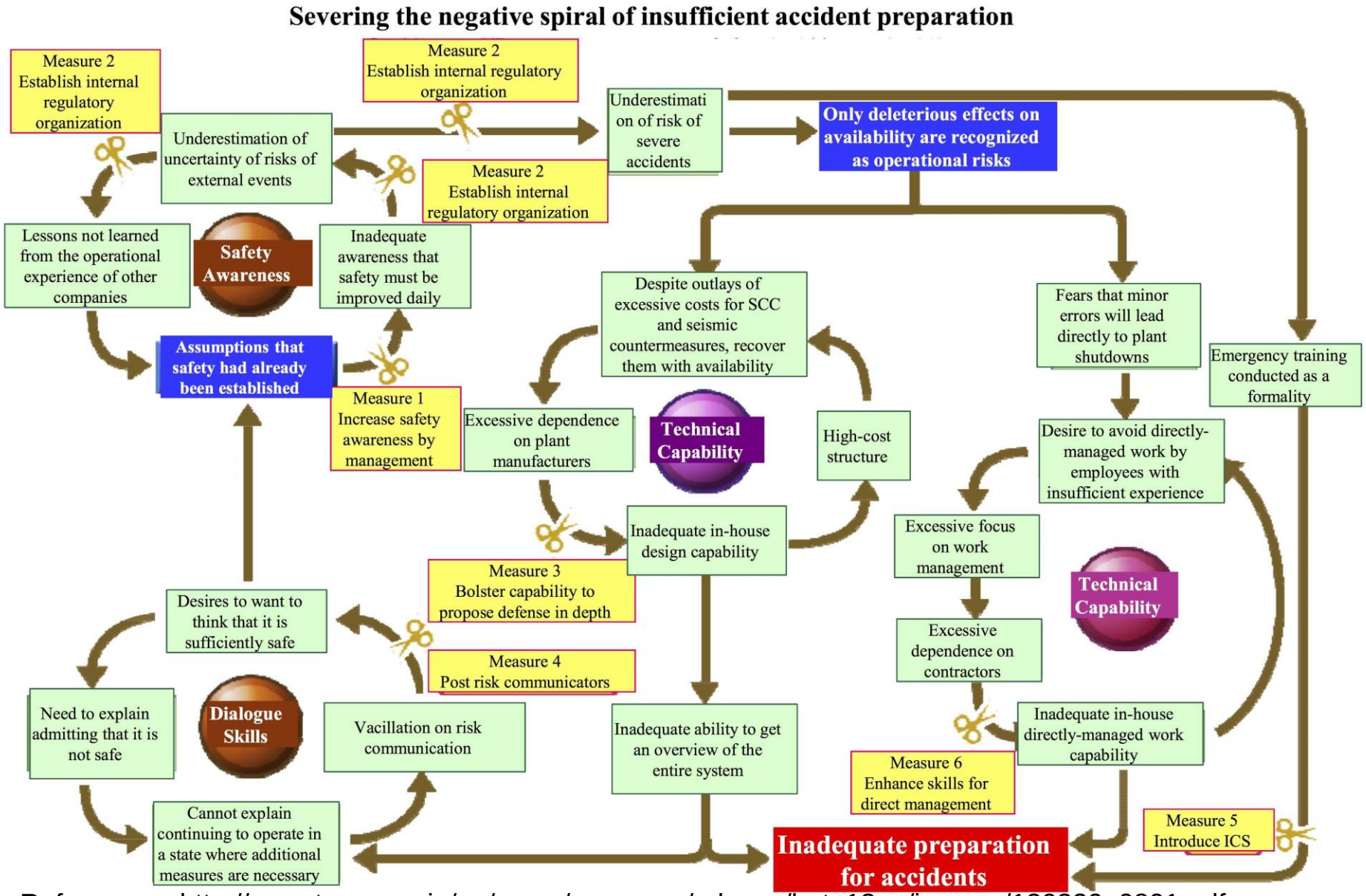
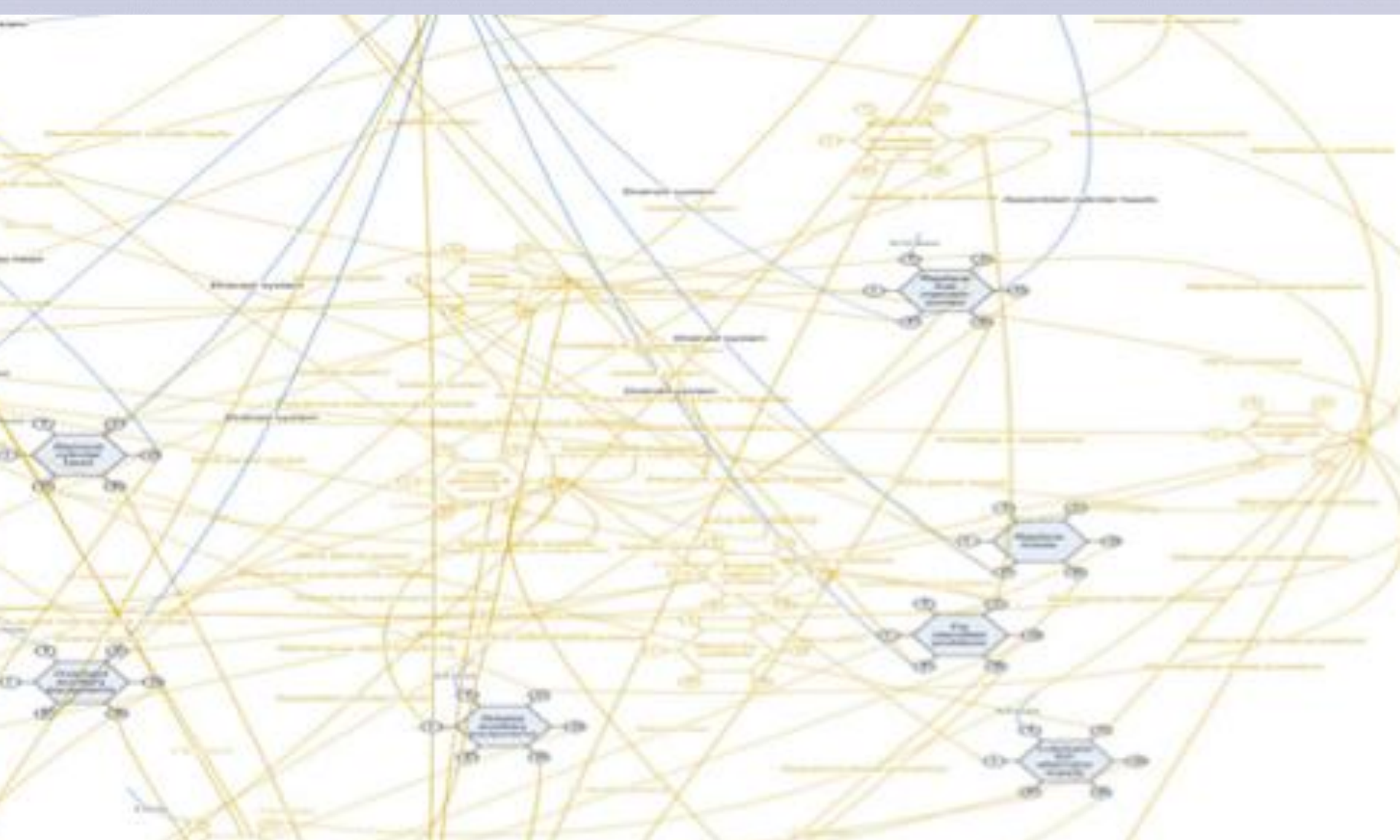
TEPCOs Systemic Self-Reflection



Reference- http://www.tepco.co.jp/en/press/corp-com/release/betu13_e/images/130329e0801.pdf



Systemic mapping of a maintenance service on an emergency diesel generator

Suggestion of Management Actions

- *Involve end-users in change process*
- *Utilize the right expertise*
- *Allow an inquiring (questioning) attitude*
- *Listen more to others and reflect*
- *Cultivate a culture for safety which fosters mindfulness and people to be heedful*
- *Balance quality and quantity*
- *Learn from research and integrate into work practices*
- *Reinforce the message of individual accountability for safety*
- *Assess and review to identify the organizational capabilities (both strengths and weakness)*

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IAEA practical Member State support on systemic safety and safety culture

- IAEA Publications
- IAEA Independent Safety Culture Assessment
- IAEA workshops and meetings
  - At IAEA Secretariat Vienna
  - In Member State organizations
  - IAEA **SCCIP** - Safety Culture Continuous Improvement Process (includes training on safety culture self-assessment)
- Tailored trainings/workshops on HTO/HOF/HFE *
- Systemic Lab – Managing the unexpected
- Training online - http://www-ns.iaea.org/training/ni/train-on-mtu.asp

* HTO=The interaction between Human, Technology and Organization
HOF=Human and Organizational Factors
HFE=Human Factor Engineering

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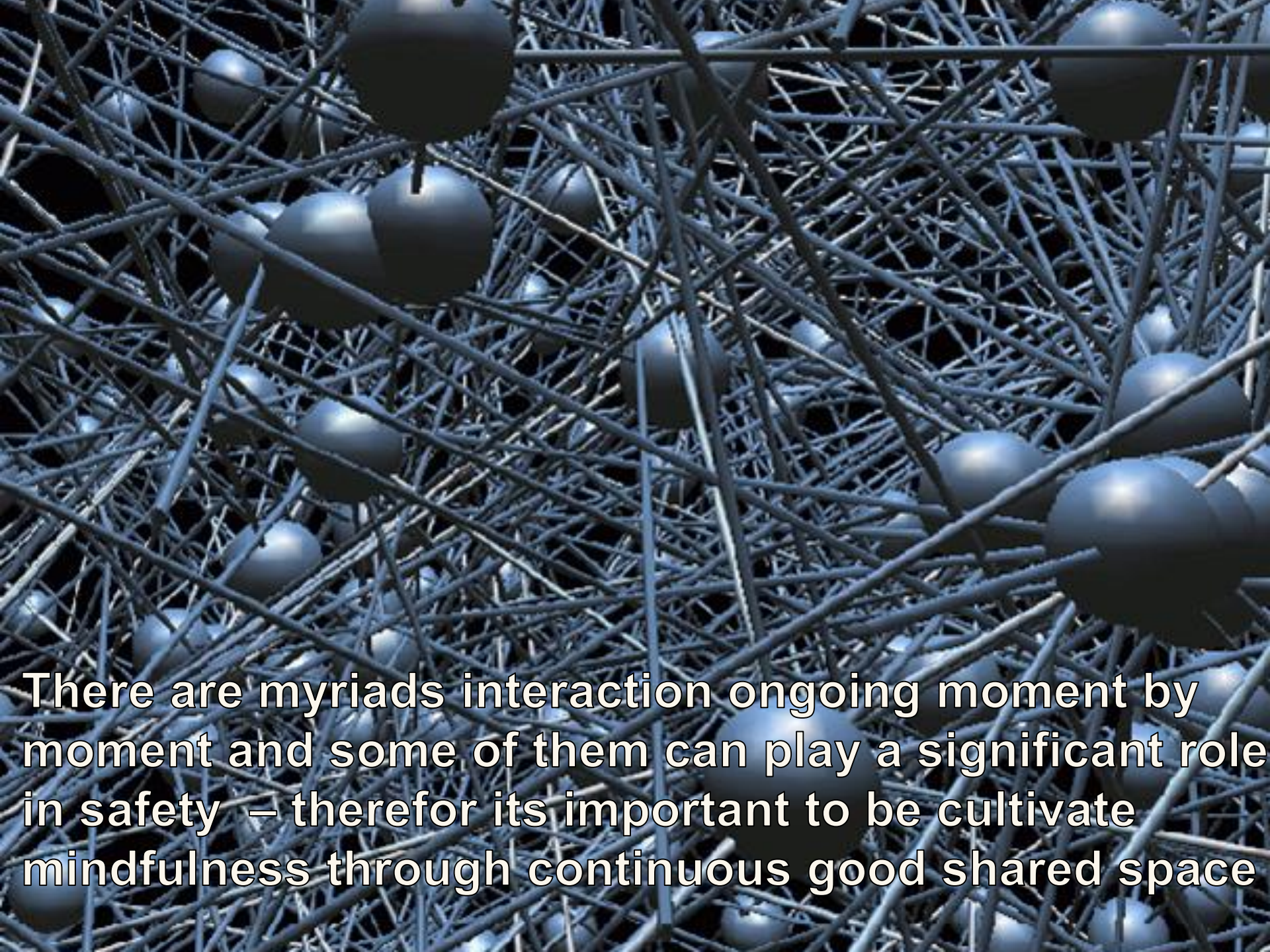

There are myriads interaction ongoing moment by moment and some of them can play a significant role in safety – therefor its important to be cultivate mindfulness through continuous good shared space

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…Thank you for your attention