

The 4th Missing Element of the ITO Systemic Approach to Safety

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According to the IAEA Report [1] the Fukushima Daiichi accident was a wake-up call for the nuclear community to recognize the complexity of safety and to respect the entire systems interaction of ITOs. The complexity of nuclear organizations is increasing, and different and more unique approaches are needed to ensure that safety is maintained. The Fukushima Daiichi accident was avoidable, according to the presentations of experts from Japan.

Taking into account the ongoing interaction between all the individual, technical and organizational (ITO) factors reveals the complexity and non-linearity of the operations at a nuclear power plant. It is necessary to better examine how the weaknesses and strengths of all these factors influence one another and to facilitate the proactive elimination of risks.

The International Experts Meeting (IEM) participants [1] emphasized that an integrated approach to safety through consideration of the interaction of ITO systems is needed to complement the more traditional approach to safety. The concept of a systemic approach to safety represents a new way of thinking about safety for some Member States and even for some IAEA activities and services.

Several considerations were identified during the meeting [1] for the development of an integrated approach to safety. In particular, the need to complement the traditional approach to safety with an ITO systemic approach was emphasized. The participants suggested that this approach might include the use of 'stress tests' for human and organizational factors (HOFs) and the further exploration of non-technical aspects of safety. Future analyses should include ITO considerations in an integrated way. Guidance and training materials for the integration of all elements of HOFs, safety culture, organizational culture, the management system and ITO factors in existing and new nuclear programmes should be developed to ensure that the systemic approach is developed and maintained.

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 [2], see Fig.1.

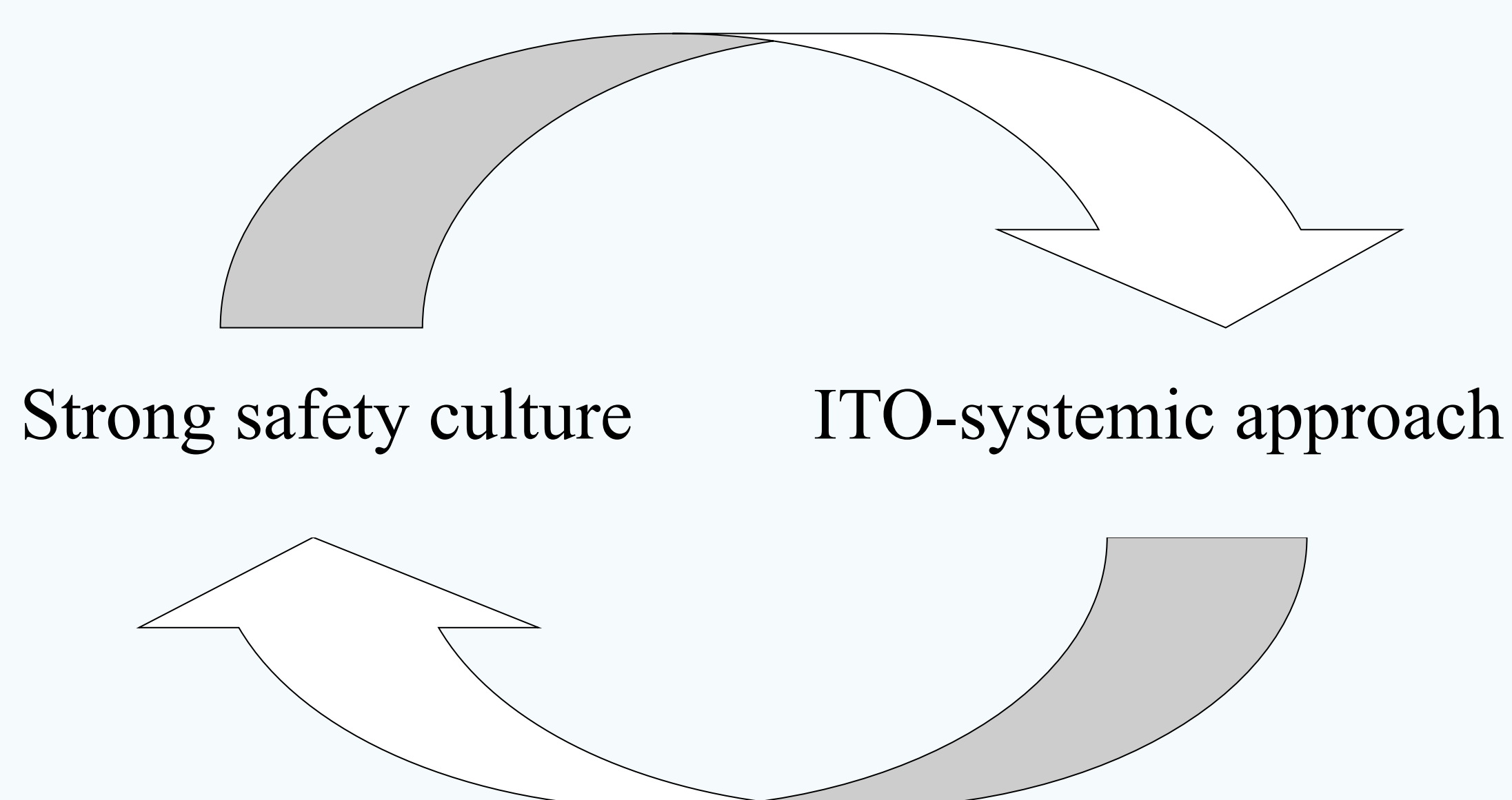


Figure 1. Strong safety culture vs ITO-systemic approach

It should be reminded that the Fukushima Daiichi nuclear disaster was initiated primarily by the tsunami after the Tōhoku earthquake on 11 March 2011, i.e. by the external natural events.

According to [1] 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).

However, the ITO systemic approach to safety doesn't consider external impacts (floods, cyclones, explosions or fire originating from off-site sources, etc. [3, 4]) on NPPs safety as well as NPPs impacts on the environment (e.g. radioactive discharges to the environment [5]).

One of the key issues in strengthening safety of nuclear facilities is the consideration of new knowledge related to the fact that our understanding of natural hazards continues to evolve, and that systematic, predictable and stable approaches are needed to address the new and significant information as it emerges [4], see Fig. 2.

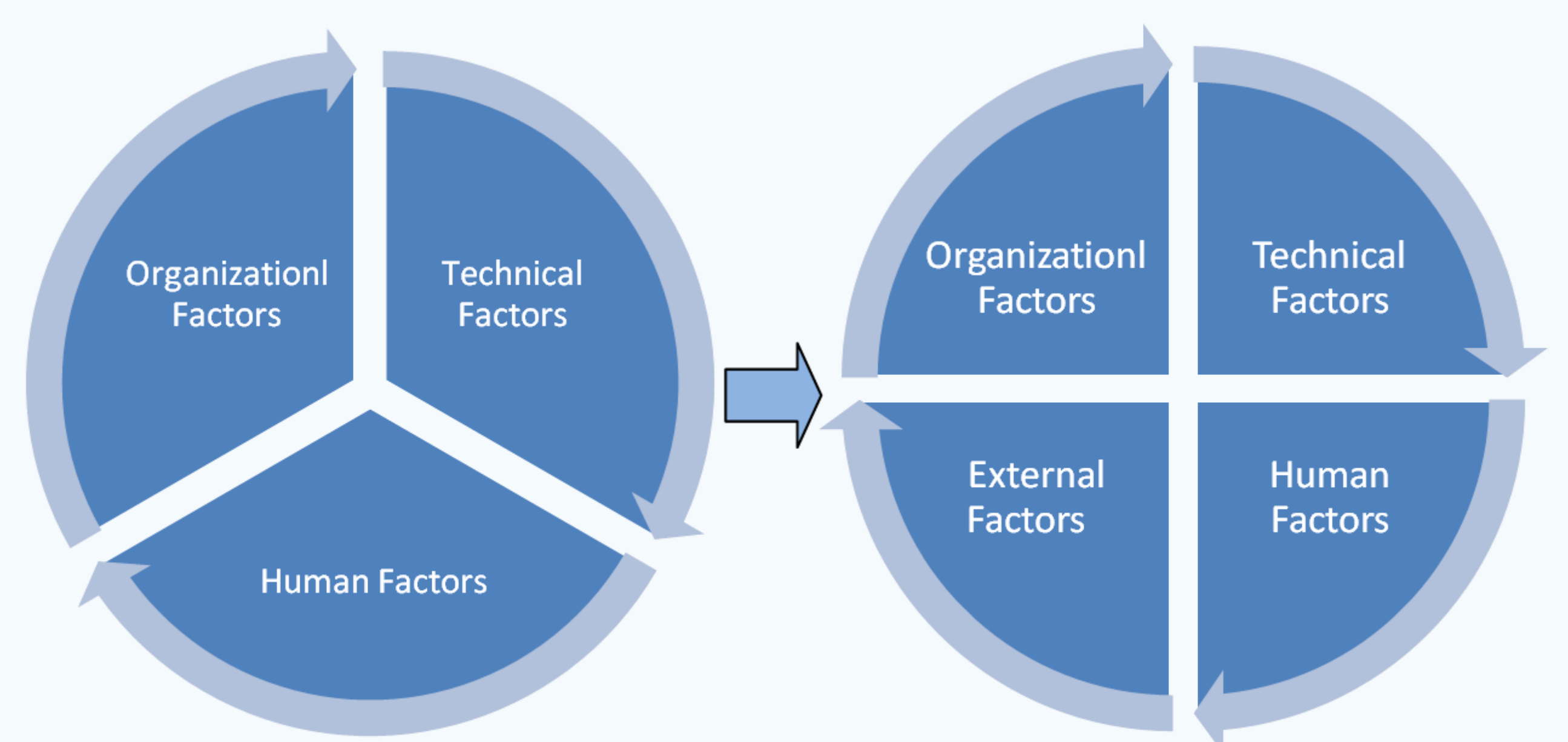


Figure 2. Evolution of the systemic approach to nuclear safety

Conclusions

In our opinion, the new approach to safety is necessary – the ITOE paradigm with its emphasis on the interrelationships and interactions of the individual (human), technical, organizational and external factors.

References

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- [2] The Management System for Nuclear Installations. Safety Guide No. GS-G-3.5. IAEA, Vienna, 2009.
- [3] NS-G-1.5. Safety Guide. External Events Excluding Earthquakes in the Design of Nuclear Power Plants. IAEA, 2003.
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- [5] WS-G-2.3. Regulatory control of radioactive discharges to the environment. IAEA, 2000.
- [6] Safety Assessment for Facilities and Activities. General Safety Requirements Part 4. IAEA, 2009.
- [7] The Interface between Safety and Security at Nuclear Power Plants. INSAG-24. A Report by the International Nuclear Safety Group. IAEA, 2010.