

## A SYSTEMIC ANALYSIS OF LEADERSHIP AND ETHICS IN THE REGULATORY FRAMEWORK THROUGH THE RADIOLOGICAL ACCIDENT IN SAMUT PRAKARN

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### EXTENDED ABSTRACT

The Samut Prakarn Cobalt-60 accident remains the most severe radiological incident in Thailand's nuclear safety history. It revealed deep-rooted systemic weaknesses in the regulatory framework surrounding the management of radioactive sources. Despite subsequent regulatory restructuring, recent incidents involving the loss of radioactive sources, [1], [2], suggest that underlying issues in safety culture persist. The recent draft report of the IAEA Integrated Regulatory Review Service Mission to Thailand [3] specifies key recommendations in the leadership and culture for safety, including the establishment of leadership for safety assessment mechanisms and the assignment of prime responsibility for safety within the national legal framework. This study therefore investigates lessons learned from the Samut Prakarn accident, which was not the result of a single failure but rather of a complex interaction of unclear responsibility, weak communication, and a reactive regulatory mindset.

Drawing on the methodology of systemic crisis analysis of the Nestucca oil spill [4] and Fukushima Daiichi [5] disasters, this study explore Thailand's nuclear regulatory environment during the management of the Samut Prakarn accident, focusing on the leadership for safety mindset and the interactions among actors within the regulatory framework. The chronological view of the Samut Prakarn accident provided in the IAEA report [6] offers official insights into the structure to the consequences of the accident, serving as a foundation for uncovering its systemic origins. As Illustrated in **Figure 1**, stakeholders involved at the time of the accident were identified and grouped into four sectors: government, international actors, civil society, and the nuclear and radiation industry. Their interactions were classified into four types: low-coupling, tight-coupling, amplifying effects, and constraining effect. These interactions were then linked to the broader issue surrounding the use of nuclear technology and the occurrence of radiological incidents in Thailand.

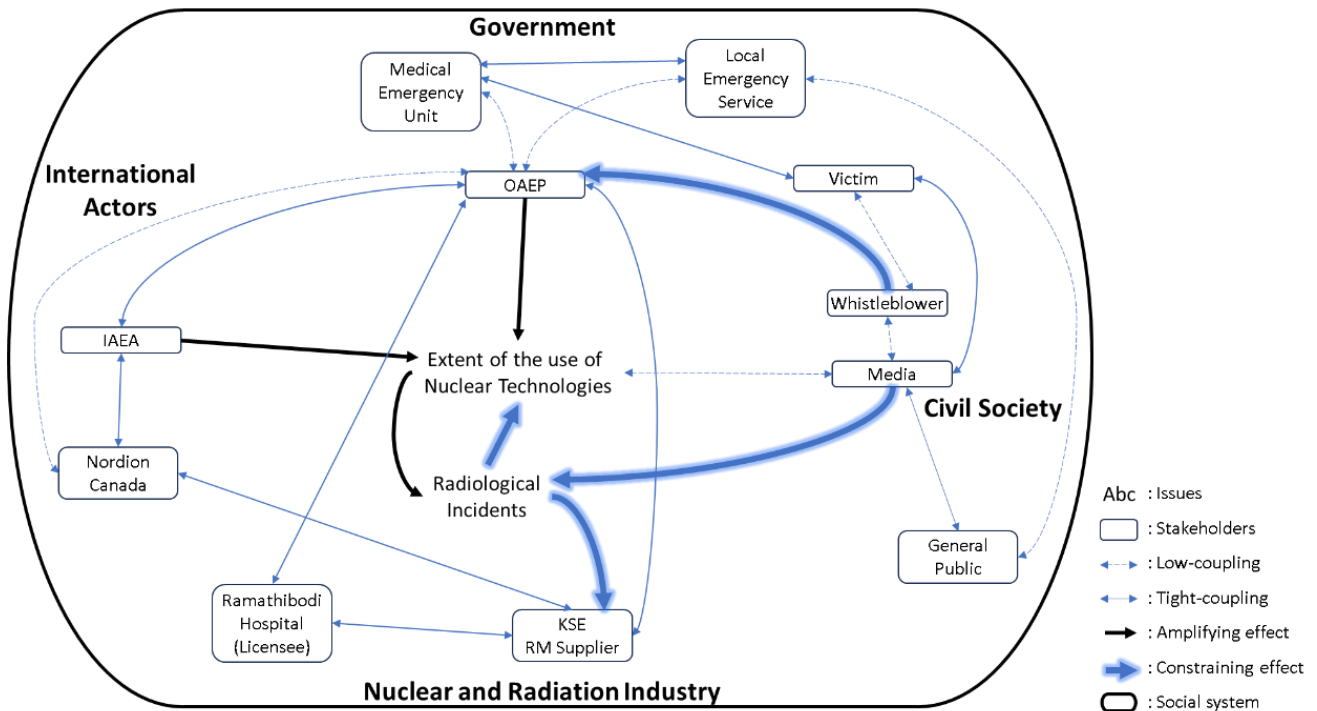


FIGURE 1. Systemic graph of interactions among actors during the Samut Prakarn accident

To move beyond “superstitious learning” where lessons from an accident are misinterpreted or ignored, an initiation of systemic changes were proposed. The stakeholder interactions depicted in **Figure 1** were used to identify the major blocks that have hindered systemic learning and safety culture development in Thailand’s nuclear and radiation safety industry. The analysis focused on four key hindering factors employed by key stakeholders:

- Basic Assumptions: Underlying beliefs that shape behavior.
- Foundation of Legitimacy: Sources of authority or justification for actions.
- Usual Scapegoats: Typical actors or factors blamed when failures occur.
- Routine Strategies: Default responses or behaviors in crisis or uncertainty.

These blocking patterns, often deeply embedded in institutional behavior, have contributed to a cycle of reactive responses and avoidance of accountability. To address this, this study proposed a set of unlocking strategies for each stakeholder group. These strategies aim to challenge the prevailing basic assumptions on safety and accountability, and foster a more preventive mindset. The hindering factors and corresponding unblocking strategies for each stakeholder are summarizes in **Table 1**.

**TABLE 1. Hindering factors and unblocking strategies for each stakeholder**

<b>Stakeholder / Hindering Factor</b>	<b>Office of Atomic Energy for Peace (OAEP)</b>	<b>Nuclear industry (e.g., hospitals, supplier)</b>	<b>Local government</b>	<b>Media</b>	<b>Public and civil society</b>
Basic assumptions	Reactive regulation; reliance on formal notification	Transfer or abandon disused sources / rely on regulatory instructions	Focus on emergency response over prevention	Focus on blame and drama; neglect systemic causes	Rely on media for information; react only during crises
Foundation of legitimacy	Technocratic control orientation	Cost avoidance	Bureaucratic ambiguity	Sensationalism	Media coverage
Usual scapegoats	Licensees, lack of notification	Regulatory body (OAEP); disposal costs	Regulatory agencies; budget constraints	Government and OAEP; industry cover-ups	Government and regulators; industry secrecy
Routine strategies	Reactive regulation	Transfer or abandon disused sources	Emergency response	Focus on drama	React during crises
Unlocking strategies	Separate regulatory and promotional functions; institutionalize leadership for safety assessments; strengthen inspection and tracking systems	Mandate takes-back or disposal plans in licensing; require financial guarantees for DSRS management	Enact comprehensive nuclear liability law; create centralized DSRS disposal fund; promote prevention as a political priority	Train journalists in science and risk communication; encourage investigative reporting on regulatory systems	Develop public education programs on radiation safety; institutionalize community engagement in safety planning

## CONCLUSION

This study provides a systemic analysis of the Samut Prakarn radiological accident, revealing that the incident was not an isolated failure but a manifestation of entrenched weaknesses in Thailand’s nuclear regulatory framework. By mapping stakeholder interactions and identifying hindering factors; such as reactive regulation, technocratic legitimacy, and routine crisis responses the research highlights how institutional behaviors have perpetuated a cycle of inadequate safety culture and accountability. The insights from this study are expected to inform improvements in the regulatory procedures of the Office of Atoms for Peace (OAP), particularly in the legislation, stakeholder communication, training of regulatory personnel, and the cultivation of a learning culture. The findings underscore the need for Thailand’s nuclear and radiation regulatory approach to evolve from a compliance-based model to one emphasizing ethics, proactive leadership, and a preventive and accountable environment.

Future research could benefit from extending the systemic framework developed in this study to a wider range of national radiological incidents, incorporating operational data from other national sectors or international contexts. Such comparative analysis would support the validation and refinement of the proposed strategies, enhancing their relevance and resilience across diverse regulatory environments. Furthermore, exploring the integration of Human Reliability Analysis (HRA) methodologies is recommended to deepen the understanding of stakeholder behavior and decision-making dynamics in complex radiological incidents.

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