Managing the Organizational and Cultural Precursors to Major Events — Recognising and Addressing Complexity

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Research at the University of Bristol, Safety Systems Research Centre [1] has drawn out the key organizational and cultural precursors leading to major events in several industries (nuclear, petrochemical, transport and major civil engineering projects). It has shown that these are strikingly similar. The research built on preliminary work reported to the IAEA in 2004 [2].

Organizational and cultural findings contributing to each event were assembled from the published reports for twelve events and grouped under eight generic headings. These were:

1. leadership issues;
2. 'local' operational attitudes and behaviours (operational 'culture');
3. the impact of the business environment (often commercial and budgetary pressures);
4. oversight and scrutiny;
5. competence and training (at all levels);
6. risk assessment and risk management (also at all levels);
7. organizational learning;
8. communication issues.

From the findings, sets of 'Expectations' were then developed as statements of good practice, which if recognised and implemented, should enable organizations to build stronger defences against the occurrence of future events. To probe operational reality, these were reformulated and developed into sets of draft 'penetrating' questions which explore whether 'reality aligns with expectation'. Initial work has been carried out to refine some of these expectations and question sets by working with industry and further work is planned. The questions can be used by both duty holders and regulators to assess the vulnerability of organizations ('condition monitoring'). Examples will be given in the presentation and full paper.

To enable organizations to address these often neglected factors, new tools are being developed that can be employed to address the risks systematically. This might be regarded as analogous to the use of systematic processes (e.g., fault and event trees) to assess risks arising from engineering and human factors-related issues. An illustration will be given of the use of Hierarchical Process Modelling (HPM) to develop a vulnerability tool using the question sets. However, to understand the issues involved more fully, requires the development of models and associated tools which recognise the complexity and interactive nature of the organizational and cultural issues involved.

Various repeating patterns of system failure appear in most of the events studied. Techniques such as System Dynamics (SD) can be used to 'map' these processes and capture the complexity involved. This highlights interdependencies, incubating vulnerabilities and the impact of time lags within systems. Two examples will be given.

In almost all of the events studied, there has been a strong disconnect between the knowledge and aspirations of senior management and those planning and carrying out operations. There has, for example, frequently been a failure to ensure that information flows up and down the management chain are effective. It has often led to conflicts between the need to maintain safety standards through exercising a cautious and questioning attitude in the light of uncertainty and the need to meet production and cost targets. Business pressures have led to shortcuts, failure to provide sufficient oversight so that leaders are aware of the true picture of process and nuclear safety at operational level (often leading to organizational 'drift'), normalisation of risks, and the establishment of a 'good news culture'. The development of this disconnect and its consequences have been shown to be interdependent, dynamic and complex.

A second example is that of gaining a better appreciation of the deeper factors involved in managing the supply chain and, in particular, of the interface with contractors. Initiating projects with unclear accountabilities and to unrealistic timescales, together with a lack of clarity about the cost implications when safety-related concerns are reported and need to be addressed, have been identified as particular vulnerabilities. Initial work on modelling has shown that the factors involved are both complex and inter-related, but learning from the research is being used to develop good practice. Examples will be given of the use of SD to provide new insights into the dynamics and complexity involved, and to provide new tools for assessing the implications of making changes ('flight simulation'). It should also enable more informed choices to be made about the most useful indicators to measure before actions are taken which can have unintended consequences — leading, in the worst scenarios, to major events.

References

[1] Taylor, R. H., *et al.*, "A Study of the Precursors Leading to 'Organizational' Accidents in Complex Industrial Settings", Process Safety and Environmental Protection, Volume 93, January 2015, pp 50–67. (sciencedirect.com/science/article/pii/S0957582014000901).
[2] Taylor, R. H., and Rycraft, H. S., "Learning from Disasters" in IAEA Conference Proceedings: Topical Issues in Nuclear. Installation Safety, Beijing, 2004