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Suggested Findings from High Reliability Organizations Research: On the Exceptionality of High Reliability and Safety

1. It is important to understand and accept as limiting factors in the pursuit of high levels of safety, that some basic properties of human cognition and behavior and their effects on the organizations they create, manage and operate are not particularly well-matched to the requirements for high reliability in safety performance relative to complex, hazardous technical systems.

2. A variety of case studies of accidents cite errors or failures related to these properties such as judgment errors in planning, technical design and in risk assessment, lapses in human communication in large organizations, as well and lapses in human commitment, motivation, judgment and attention suggest these among other properties as direct or latent elements in major safety failures[1].

3. Conversely, detailed investigation and description of long-standing success in the safe operations of complex and highly hazardous technical systems in High Reliability Organizations (HRO) research reveals the importance of *exceptional* individual and organizational characteristics in their success[2].

4. For example, among unusual individual elements among these ongoing successful organizations are the presence of "reliability and safety professionals" (RSPs), noted in several accounts of high reliability safety performance. These individuals, who can be identified in a number of organizational units and across hierarchical levels have internalized a personal identity and responsibility as "safety professionals". They are intensely, if not obsessively, committed to system reliability and safety including paying attention to potential safety risks all the time, even outside of their unit or department and beyond their formal job description and responsibilities.

5. Who are reliability and safety professionals?.

- They internalize norms about safety and invest their identity in the reliable and safe operation of their systems.
- These individuals, generally part of teams, have special perspectives on reliability in safety, both cognitively and normatively.
- They mix both formal deductive and experiential knowledge in their understanding of the systems they operate and manage.
- Their view of responsibility for safety extends to "systems" and is larger than their tasks and frequently centered on both long-term and real-time operations.

Reliability and safety professionals were found in an organizations among:

- control operators ,
- line production or maintenance personnel,
- engineering and other technical personnel who support operators and maintenance,
- middle-level managers
- department heads,
- CEOs or agency heads

6. It is also an important finding in HRO research that safety is found not in trying to maintain invariance in all human and system activities but in the management of fluctuations that can occur in individuals and organization in such things as mindfulness, trust, shared sensemaking, as well as in communication and cooperation among members.

7. Awareness of these potential fluctuations leads to the analysis of and watchfulness for shifts that might lead in a chain of causation to errors and failures that threaten safety. The idea is to be on constant lookout for these precursor fluctuations and to keep them within a narrow and correctable bandwidth.

8. The risks of *safety drift*. The development of a clear precursor zone relative to safety establishes a form of precursor resilience. This resilience and the individuals who participate in it are a protection against *safety drift*. Safety drift is the migration away from cognitive, behavioral as well as organizational stares that support reliable safety performance[3].

Safety drift can happen because of a number of factors:

- There are practical adjustments in task performance at local levels away from formally specified procedures, often to correct for procedural incompleteness or error or to save time and/or effort. This becomes a reliability drift if others are not aware of the procedural departures, or if the larger system implications of them are unexplored.
- *policy* adjustments at higher levels of an organization that reflect shifts in balances between goals of reliability and safety vs speed, efficiency, cost containment and other objectives. This becomes a safety drift if it means that reliability commitments and support diminish implicitly in an organization in the service of these alternative objectives.
- a *sectoral* shift among similar competitive organizations that establishes these policy adjustments as a common industry practice and a requirement for survival in the face of sectoral competition. A recent example is the mutual shift of organizations in the banking sector toward higher rates of return for shareholders, investors and depositors which led to riskier loans and investment policies for all of them. This led to a major reliability drift away from previous risk management standards in banking practice and top a near collapse of the financial sector into recession.

- a shift in *societal* concern for reliability and safety, toward other objectives -- e.g. cheaper or faster service -- which can lead to political and regulatory drift away from safety toward alternate objectives.
- Another shift can also underlie a "safety failure cycle" -- complacency that arises in risk management during a long the time periods between accidents.

9. Reliability and safety professionals can help constrain safety drift in several ways:

- They can detect "weak signals" concerning changes in conditions of operations that degrade reliability. They can identify personal precursor zones with respect to acceptable bandwidths in organizational conditions and their own performance capabilities;
- They can police their own movements towards practical drift because they are likely to take a larger system perspective and think about system risks and consequences of changes they make in their own task domain.
- They can add “mindful inertia” -- resistance and critical appraisals to balance forces pushing for under-analyzed organizational change (Binci and Cerruti, 2012).
- In some settings (e.g. nuclear power, aviation and ATC) RSPs who are control operators can and do refuse to operate their systems under conditions that lie outside their domain of comfort and confidence.

10. A safety culture must support excellence in an organization that includes exceptional levels of persistence in commitment and motivation, a close attention and awareness that is widespread to unusual events or conditions and that isn‘t dulled by the routinization of tasks, as well as intensive and renewed training and team-building, and a continuing search for improvement at *all* levels of the organization.

A regulatory analyst, Scott Hemphill, explains the implications of this perspective in a very incisive quote: “If an organization is managed and regulated to adequacy rather than excellence then lapses in performance will be away from adequacy and not excellence.”

11. These issues have major importance for the annual safety reviews to be undertaken by the individual utilities as well as assessments taken every four years by the CPUC. These reviews and assessments should address the degree to which each organization is working to promote exceptional levels in human performance with respect to the qualities noted above and the managerial and organizational foundations necessary to support this performance and the elements of safety culture that reinforce it.

12. Additional dimensions of excellence in safety operations:

- A high degree of settled and shared knowledge underlying reliable and safe operations of major technical systems

- A strong normative commitment among RSPs in teams to overall system reliability
- Skills among RSPs in pattern recognition and system-level analysis
- Experiential learning plus memory of cases and scenarios for "recognition-primed" decision-making (Klein, 1998).
- Team reinforcement for these skills and a complementarity of experience and memories.
- Sensitivity to the limits of these skills and to conditions which erode them
- Higher management support for RSPs when concerns are voiced about precursor conditions (with accepted signalling language for these such as "I find myself in unstaried conditions."), and/or
- Recognized "veto" power -- individually or within teams -- to cease operations deemed unsafe.

13. Indicators of safety drift might include:

- Decline in integrated work planning sessions and inter-departmental problem-solving
- Loss in numbers, distribution and influence of RSPs
- Decline in management support for RSP voice and erosion of operational veto power
- Loss of experiential knowledge and system perspective among operators and analysts
- Operational errors and events that can reflect changes in cognitive performance (e.g. loss of attention or care in task performance or communication lapses)
- Frequent maintenance redo's
- Lag time or backlog in corrective actions
- Non-compliance reports or chronically late contractor deliveries;
- Fluctuations in performance across crews and shifts, in overnight turnovers. and between peak load vs off peak periods).

14. What are the implications of this for safety management and safety regulation?

One implication is to heighten the importance of both yearly safety appraisals within the individual infrastructure organizations with the development and improvement of indicators such as those suggested above of *drift potential*. Also the potential of the CPUC in its own multi-year safety culture assessments to broaden out measures and indicators that reach down to individual attitudes and commitment to safety, cognition and behavior. It might help these regulatory assessment efforts to have inspectors for each utility, possibly in teams, who are trained in safety culture and what to look for both positively and negatively in observed behavior and organizational conditions. Inspectors who visit often and at times unannounced,

who talk to personnel at multiple levels and who can report their findings in both utility reviews and CPUC assessments.

An important ongoing development at the CPUC is that the Utility Safety Culture Working Sub Group is now meeting and its members are working diligently to describe and craft organizations that in their culture and individual behavior will be excellent and exceptional in their commitment in the management of safety and safety improvement. This is highly admirable and noble work.

Notes

1. See, for example, Vaughan, D., The Challenger Launch Decision (University of Chicago Press 1997); Boebert, E. and Blossom, J. Deepwater Horizon: A systems Analysis of the Macondo Disaster (Harvard University Press 2016); Starbuck, W. and Farjoun, M. (eds.), Organization at the Limit: Lessons From the Columbia Disaster (John Wiley & Sons, 2005). and, more generally, Bazerman, M. and Watkins, M. Predictable Surprises: The Disasters You Should Have Seen Coming (Harvard University Business Press, 2004); Savage, S. The Flaw of Averages: Why We Underestimate Risk in the face of Uncertainty (John Wiley, 2009) and Kahneman, D. Thinking Fast and Thinking Slow (Farrar, Straus and Giroux, 2011).
2. See for example LaPorte, R.R. “High Reliability Organizations: Unlikely Demanding and At Risk” (Journal of Contingencies and Crisis Management 1996), LaPorte and Consolini, P. “Working in Practice But Not in Theory: Theoretical Challenges to High Reliability Organizations” (Public Administration Research and Theory, 1991); Roberts, K.(ed). New Challenges to Understanding Organizations (MacMillan “ Some Characteristics of one Type of High Reliability Organization (Organization Science, 1990); Roberts1993); Rochlin, G, LaPorte, T.R. and Roberts, K. “The Self-Designing High Reliability Organization: Aircraft Carrier Flight Operations At Sea” Naval War College Review (1987); Schulman P. “The Negotiated Order of Organizational Reliability,” Administration and Society, 1993; Schulman “General Attributes of Safe Organizations” Quality and Safety in Health Care, 2004), Roe, E. and Schulman, High Reliability Management (Stanford University Press, 2008 and Klein, G. Sources of Power M.I.T. Press, 1998).
3. (Pettersen Gould, K. and Schulman, P. “Drift, Adaptation, Resilience and Reliability: Toward An Empirical Clarification” (Safety Science, v. 117, 2019). See also Dekker, S. Drift into Failure (Ashgate, 2011).