Two Case Studies Demonstrating the 'Psychological Imperative' for Safety Critical Task Analysis

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SUMMARY

Safety Critical Task Analysis (SCTA) is a structured activity, used to identify and mitigate risks associated with human actions / inactions for critical tasks on Major Accident Hazards (MAH). SCTA is widely accepted as part of a project in high-hazard industries (e.g. chemical processing and oil & gas) and is most often allocated to the Human Factors Engineering (HFE) scope of work. The common methods, now widely accepted (thanks to efforts from a generation of HFE evangelists) include references to human error / failures, Performance Influencing Factors (PIFs) and a range of psychological and socio-technical influences / drivers / responses. As HFE professionals we must very strongly focus and develop these human-centred areas of risk management because the designers, technicians and engineering disciplines involved in the assessments do not have the training, skills or focus to do so. The outcome of either sidelining or promoting solutions requiring psychological consideration, is compared in 2 case studies.

KEYWORDS

SCTA, MAH, Psychology, Case Studies

SCTA Methods

Long standing methods for human factors analysis of safety critical tasks are used in the energy industry. These are commonly based on the Offshore Technology Report - OTO 1999 092, and have been internationally upheld and circulated in the Energy Institute's 2020 guide to SCTA, UK's Control of Major Accident Hazards (COMAH) Regs (2015) and in IOGP 454: Human Factors Engineering in Projects (2020). The method structure is very familiar to safety and engineering professionals and includes: task identification /analysis; description of problem consequences, understanding the human part in those problems; then prevention or mitigation measures.

Different from other safety studies (e.g. Hazard and Operability (HAZOP) or Layers of Protection Analysis (LOPA)) this method is for human factors. It therefore contains vital psychological markers, pointing to the importance of the human in the designed systems and their strengths and frailties when it comes to performance - in particular on tasks where consequences of failure could include their death or other serious harm to people or the environment.

It is difficult to overstate the importance of SCTA methods in getting HFE involved in project stages previously 'engineer-only'. Now we are included, we need to ensure people are properly represented and supported in the socio-technical systems that so often let them down. SCTA has checklists for 'human error / failure', 'error types' and PIFs. What it is missing is requirement for stepwise solution development of those identified problems. As HFE experts, we must bring that expertise to the analysis. Engineers are capable of finding design solutions for the 5 levels of

hierarchy of control. We must be the force to tackle the external and internal factors leading to performance variations: the individual and organisational psychology; the socio-technical systems that support best performance and encourage compliance; usable procedures within a supportive culture.

Case Study 1: SCTA for a Floating Production, Storage and Offloading vessel (FPSO) design

Detailed Design phase involves development of accurate 3D models for both the Production-based 'topsides' and the Storage-based hull, including workshops and living quarters. Equipment is being ordered and early construction is underway. Design review workshops are checking layouts, access, handling routes, cable routing etc., for all the main items and can last 2 months each. HFE focus tends to be on escape routes, accessways, changes in height and reaching of equipment, perhaps for up to 5 days of Operations' and Engineering teams' time.

In this context the SCTA workshop is scheduled for 5 additional days. The standard SCTA methods were used by HFE professionals, who produced itemised and detailed worksheets to fit the running order and question sets for the stakeholders from 3 engineering firms and Client Operations.

A definition of 'safety critical' was not agreed, so a long list of tasks was included. OTO 092 screening questions were adapted by the HFE team to include process and operational tasks. Robust assessment and filtering was done, with an audience used to HAZOPs. Using the normal guidewords, tasks listed possible 'Human Errors' and PIFs reasonably expected to be present.

But PIFs were not treated as signposts to problems in the socio-technical systems. Of 32 SCT recommendations, 31 directly or indirectly required a procedure. PIFs listed, but remaining unaddressed included: Workload, Divided attention, Communication with colleagues / supervisors, Fatigue, Time available vs Time required. The SCTA is not scheduled to be repeated. HFE are unlikely to be included in the procedure development or review. MAH risks remain unmanaged.

Case Study 2: SCTA for Onshore Chemical processing plant's COMAH changes

Two current safety critical procedures affected by plant changes needed SCTA, as required by the COMAH regs. Walk-through-talk-through of predicted steps in the procedures highlighted a number of feasible errors in critical steps. As per SCTA methods, more detailed task analysis was performed on these steps. Discussion on error types and, in particular, PIFS for these situations highlighted significant issues with workload, pressure, supervision, communication and planning for 3rd party contractor management.

To address specific task steps and the associated PIFs, HFE called for a detailed workload study on 2 sites likely to be impacted. That study indicated planned changes to shift patterns and a supervisory job role would undermine risk management of some safety critical tasks under certain conditions. The unions were consulted further about the role amendments. PIFs also highlighted pressure on individuals to leave monitoring a critical task was identified, when a 3rd party supplier arrived on site and wanted their vehicles unloaded. The changes were incompatible and the HFE team made recommendations that procurement and delivery agreements / schedules were amended. This would not have come to light except through the PIF reduction measures of the SCTA. The pressure on individuals to manage site safety and production while supervising 3rd party delivery, out of hours, without supervisor support was having a very significant effect on performance pressure (stress), perceptions of risk, cultural view of violations, and over-riding of lock-out safety devices on some equipment. These are now being addressed at a Corporate level.

References

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