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Accounting for Human Error Probability in Layer of Protection Analysis

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ABSTRACT

Layer of Protection Analysis (LOPA) is often applied to process safety scenarios where human performance contributes to both the initiating event, and the reliability of associated protective safeguards. In such circumstances, process safety practitioners can benefit from employing systematic, and defensible methods for estimating, and integrating human error probability (HEP) into the LOPA process. However, guidance on how to account for HEP within LOPA has been historically limited and ambiguous. As a result, practitioners commonly rely on standardised, overly conservative HEP values. This practice can inflate residual risk estimates, and lead to the assignment of overly conservative Safety Integrity Level (SILs) requirements for Safety Instrumented Functions (SIFs). Such conservatism can drive unnecessary, or misdirected capital and operational expenditure.

A more sophisticated approach to human error probability estimation and integration, involves use of task-based, context-sensitive human reliability analysis methods derived from the discipline of human factors. Integrating these methods into LOPA supports more nuanced understanding of the human contribution to the scenarios of interest, and more proportionate SIL assignment. This paper outlines contemporary perspectives on human reliability analysis, and provides guidance on selecting, performing, and incorporating established human error probability estimation techniques – drawn from the human factors discipline – into the LOPA workflow. Examples from industry experience illustrate the practice and value of integrating HEP estimation into LOPA.

KEY WORDS

Quantitative Risk Analysis, Layer of Protection Analysis, Human Reliability Analysis, Human Error Probability, Human Factors

BIOGRAPHY

Include a short biographical (100 words) for the presenting author

Amelia Keates is a Registered Psychologist (Organisational), and human factors practitioner within Frazer-Nash Consultancy Australia's System Safety & Assurance practice group. Amelia has over seven years of experience designing and managing human factors assessment, integration and assurance projects across complex safety-critical industries, including Rail, Civil Air Traffic Control, Defence, and Mining. This has included projects ranging in scale from broadscale human factors integration programmes across the engineering lifecycle, to narrowed human reliability analyses, Control Room design assessments and critical incident investigations. Amelia currently serves as South Australian Director, and Branch Chair for the Human Factors and Ergonomic Society Australia.

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