



**MARY KAY O'CONNOR
PROCESS SAFETY CENTER**
TEXAS A&M ENGINEERING EXPERIMENT STATION

20th Annual International Symposium
October 24-26, 2017 • College Station, Texas

Impact of the 70% Rule on Interlock Design

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ABSTRACT

The IEC 61511 standard requires a verification calculation that a proposed design for a safety instrumented function (SIF) achieves the desired safety integrity level (SIL). The evaluation of the safety integrity level of a new or existing safety instrumented system requires detailed calculations based on the failure rates of the device and the planned maintenance -testing cycle for the system. In the design of a new safety interlock, the IEC 61508 and IEC 61511 standards require the use of the 70% failure rate estimate to evaluate the interlock design.

Previously, Freeman demonstrated a method based on probability theory to account for the uncertainty in the underlying design data. The Freeman method uses the average failure rate estimate for the hardware devices and adjusts the design target risk reduction factor (RRF) to achieve a specified confidence of the interlock working at least as well as specified. The IEC standards instead use the fixed failure rate estimate at the 70% point to estimate the interlock RRF. The resulting estimate is then compared with the desired RRF to validate that the design is adequate to achieve its purpose. This paper compares the two approaches to give the engineer guidance on the design of the interlock system. An example is worked to compare the two methods.