ISO/TR 12489 – Information sheet
N. BERNE, 24th of July 2023

Production assurance and safety represent the two faces of risk in the field of oil and gas industry, including petrochemical and lower carbon energy activities.

The ISO/TC67/WG4 (“Reliability engineering and technology”) is responsible for various reliability related standards like:


The technical report ISO/TR 12489 (“Reliability modelling and calculation of safety systems”) is informed about in this short information sheet. The ISO/TC67/WG4 convener is Runar Østebo (Equinor, Norway) and the WG4 secretary is Endre Willmann (WG4 Secretariat, Standard Norway). Separate project groups are responsible for each standard, and other standards are ISO 15663 (“Life cycle costing”), ISO 19008 (“Standard Cost Coding System for oil and gas production and processing facilities”), and ISO/TS 3250 (“Calculation and reporting of production efficiency in the operating phase”) – see ISO/TC67 Standard Committee webpage for more information.

Eleven countries were involved in the development of ISO/TR 12489 and Jean-Pierre Signoret (TotalEnergies, France) was the project leader of the ISO/TC67/WG4 Project group 3, which has developed the ISO/TR 12489 shortly described hereafter.

The ISO/TR 12489 provides guidelines to reliability & safety engineers who deal with probabilistic approaches which, in association with qualitative considerations, are increasingly used to design reliable safety systems. This is encouraged by regulations (e.g. SEVESO directive) or widely recognized standards (e.g. the SIL approach recommended for safety instrumented systems by the IEC 61508 standard and the sectoral derived standards like IEC 61511 related to process systems). This implies meeting various probability requirements, but these probabilistic matters are rather briefly documented in standards and not really satisfactorily addressed in reliability textbooks. Therefore, the ISO/TR 12489 aims at closing this gap by establishing a sound specific probabilistic background, helping the reliability engineers to properly deal with the probabilistic modelling and calculations of any type of safety systems (e.g. ESD, High Integrity Pressure Protection System, etc.). After gathering the relevant definitions and raising the typical challenges, the technical report explains in detail how to solve them. It analyses in detail how simplified formulae can be established for simple safety systems and how the common standardized models – reliability block diagrams (IEC 61078), fault trees (IEC 61025), Markovian approach (IEC 61165) and Petri nets (IEC 62551) – may be used to deal with more complex situations. Moreover, ISO/TR 12489 develops in detail the approaches mentioned in the IEC 61508:2010 Part 6 Annex B for SIL related calculations. It provides also guidelines about the multiple safety systems mentioned in the IEC 61511 ed. 2, which was released in 2016. ISO/TR 12489 is also addressed in NOG-070:2022, NORSOK U-001:2021, PDS handbooks (2021), and ISA 84.00.02-2022.

When designing safety systems, a common leading idea is that the risk totally disappears when safe states are reached and that spurious actions don't really matter. This is particularly questionable in petroleum, petrochemical and natural gas industries where, beyond the undesirable side effects on production availability, there are also undesirable side effects on safety: pressure increasing after shutdown (e.g. oil & gas production systems), increasing number of process restarts where accidents often occur, etc. Therefore, the ISO/TR 12489 provides guidelines for evaluating the spurious failure frequencies in order to find good compromises between dangerous and spurious failure probabilities or frequencies. A comprehensive clause has been developed to present typical examples of application encountered in oil and gas industry (instrumented or not) and illustrating how the ISO/TR 12489 content can be effectively implemented by reliability engineers.

Applying ISO/TR 12489 strengthens reliability assessments of safety systems in the industry by providing guidance on the techniques that can be used according to safety system type and its operation mode. These benefits have been recently presented in OTC Conference 2023. It was notably recognized in March 2015 report from the ISO/TC67 Ad Hoc Group on Industry Events (ref. Montara and Macondo accidents), where ISO/TR 12489 was listed as a high activity (priority 2) within the entire oil & gas arena related to relevant standardization. It demonstrates the need for “international standards used locally worldwide” (ISO/TC67’s vision statement).

The ISO/TR 12489 development work started in November 2008 and the document was approved in March 2013. Finally, ISO/TR 12489 was issued by ISO in November 2013. Furthermore, it was approved by CEN (i.e. by the European National Committees) 28th March 2015 and issued 27th January 2016 as CEN ISO/TR 12489 and has currently been officially adopted by 26 CEN-member countries, plus France also using it. Since 2013 many international dissemination activities and courses have been done and more is currently in progress. Nicolas Berne (LGM, France) is now the interim project leader for ISO/TR 12489 in ISO/TC67/WG4, which consists of 20 experts from 9 ISO/TC67 member countries across the world.

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