Safety Corner

What is Common-Cause Failure?

Dependent or Common-Cause Failures (CCF) can lead to simultaneous, or within the mission time, failure of redundant components and defeat the redundancy incorporated into engineering designs that aim to improve system reliability.

There are three basic groups of CCF:

1. Design, manufacturing, construction, installation inadequacy or error, or other internal faults that can cause similar components to malfunction, both before and after the system is operational. System design diversification, quality assurance during the manufacturing process, and good management practices can provide significant defense against potential CCF from this group.
2. Abnormal environmental stress can affect equipment that is sensitive to the harsh environment that is not within the specific design criteria. This potential CCF can be significantly reduced by reducing the susceptibility of the redundant components to a common stress; e.g., locating redundant components of a safety system in different physical locations separated by fire and flood barriers.
3. Maintenance or operation errors can also affect equipment operated or maintained according to the same procedures or by the same workers. Good management practices and well-conducted testing and maintenance programs can provide significant defense against these potential CCF.

Analysis for potential CCF typically includes the following steps:

1. Identify groups of components that are considered to have a high potential for failure due to the same cause. The identification of common-cause component groups can be based on a qualitative screening analysis within each system and among different redundant systems performing the same function.
2. Identify credible failure modes, inter-component dependencies, and failures due to shared root cause of failures.
3. Identify other causes such as credible accident initiating events, mechanisms, or triggering events.
4. Identify design or operational defenses to reduce the susceptibility to CCF and to provide the bases to screen out components from the common-cause component group.
5. Recommend corrective actions.

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