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Integrity verification of safety critical elements

Independent integrity verification of safety critical elements is undergoing a steep change. The regime, once restricted to the United Kingdom North Sea, has undergone a significant expansion and development to wider markets and a variety of legislative frameworks.

Originally tracing its development from the Piper Alpha accident in the United Kingdom North Sea in 1988 and via the "Cullen Inquiry Report," to Health and Safety Executive legislation, the process of technical integrity assurance of safety critical elements has evolved and spread to many areas of the world's oil and gas industry, as well as other industries. This has been due to two influences — changes in corporate policy and legislative influences.

Initial changes in corporate policy were primarily in response to the United Kingdom's legislation. However, in the past 10 years, many internationally active companies have voluntarily adopted such a regime as corporate policy. The more recent BP Texas City, Texas, accident and its subsequent BP U.S. Refineries Independent Safety Review Panel report identified issues, which have prompted many companies to assess their integrity management processes in relation to safety critical elements.

Safety critical elements (SCE) are systems, equipment, software, structures and in some companies or governing legislation, procedures, which help to do the following:

- Identify failures that would cause a major accident hazard.
- Provide a significant role in the prevention, mitigation, control or emergency response to a major accident hazard (MAH).

Most legislation and companies define (in slightly different ways) an MAH as one which causes significant impact to people, environment or assets. Some regimes also include environment and assets within the overall integrity verification process, although in its original form only the impact on people is considered. The objective is to focus integrity resources to enhance the performance of equipment, systems, etc., which provide the most significant contribution to the management of risks relating to major accidents.

From the above principles, the SCEs can be identified through the use of risk assessment techniques, including quantitative risk assessments and bow-ties. The risk assessment process enables an understanding of the role played in relation to management of major accident hazard risks for each SCE. From this it is possible to define their performance requirements in relation to the full life-cycle — design to operations/maintenance and then decommissioning. Such performance standards would include performance acceptance criteria, and the associated integrity assurance activities that would be carried out by the asset operator/owner. For example, equipment inspection, testing and maintenance would be aligned to ensure achievement of performance standard requirements appropriate to the operating/maintenance phase.

In order to be able to demonstrate the process to itself and/or to a regulator, the asset operator/owner would subject this process to independent competent verification. In many regimes, this entails the use of a third-party company — an independent verification body (IVB). The IVB tasks would be defined, managed, recorded and reported through a written scheme of verification. The implementation of verification tasks by the IVB would be executed via a written scheme of examination.

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Recognizing that other independent competent organizations are often utilized on project execution and operations/maintenance, an IVB would be able to take credit for their activities, provided they are aligned to the SCE performance standards and other aspects related to competence, reporting and management systems/procedures.

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