Risk-Based Inspection Methodology

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Risk-based Inspection Methodology
Part 1—Introduction to Risk-based Inspection Methodology

1 Scope

1.1 Purpose

This recommended practice, API 581, provides semiquantitative analysis procedures to establish an inspection program using risk-based methods for pressurized fixed equipment including pressure vessel, piping, tankage, pressure-relief devices (PRDs), and heat exchanger tube bundles. API 580 provides guidance for developing Risk-Based Inspection (RBI) programs on fixed equipment in refining, petrochemical, chemical process plants, and oil and gas production facilities. The intent is for API 580 to introduce the principles and present minimum general guidelines for RBI, while this recommended practice provides examples of semiquantitative calculation methods to determine risk and associated inspection plan.

1.2 General

The calculation of risk outlined in API 581 involves the determination of a probability of failure (POF) combined with the consequence of failure (COF). Failure is defined as a loss of containment from the pressure boundary resulting in leakage to the atmosphere or rupture of a pressurized component. Risk increases as damage accumulates during in-service operation as the risk tolerance or risk target is approached and an inspection is recommended of sufficient effectiveness to better quantify the damage state of the component. The inspection action itself does not reduce the risk; however, it does reduce uncertainty and therefore allows more accurate quantification of the damage present in the component.

1.3 Risk Management

In most situations, once risks have been identified, alternate opportunities are available to reduce them. However, nearly all major commercial losses are the result of a failure to understand or manage risk. In the past, the focus of a risk assessment has been on-site safety-related issues. Presently, there is an increased awareness of the need to assess risk resulting from:

a) on-site risk to employees,

b) off-site risk to the community,

c) business interruption risks, and

d) risk of damage to the environment.

Any combination of these types of risks may be factored into decisions concerning when, where, and how to inspect equipment.

The overall risk of a plant may be managed by focusing inspection efforts on the process equipment with higher risk. API 581 provides a basis for managing risk by making an informed decision on inspection frequency, level of detail, and types of nondestructive examination (NDE). It is a consensus document containing methodology that owner–operators may apply to their RBI programs. In most plants, a large percent of the total unit risk will be concentrated in a relatively small percent of the equipment items. These potential higher risk components may require greater attention, perhaps through a revised inspection plan. The cost of the increased inspection effort can sometimes be offset by reducing excessive inspection efforts in the areas identified as having lower risk. Inspection will continue to be conducted as defined in existing working documents, but priorities, scope, and frequencies can be guided by the methodology contained in API 581.

This approach can be made cost-effective by integration with industry initiatives and government regulations, such as *Process Safety Management of Highly Hazardous Chemicals* (OSHA 29 *CFR* 1910.119), or the EPA risk management programs for chemical accident release prevention [Section 112(r) of the Clean Air Act amendments], or *Oil and Gas and Sulphur Operations in the Outer Continental Shelf* (30 *CFR* Part 250).