

AACE
INTERNATIONAL
RECOMMENDED
PRACTICE

112R-20

**COST ESTIMATE CLASSIFICATION
SYSTEM – AS APPLIED IN
MAINTENANCE TURNAROUNDS
FOR THE PROCESS
INDUSTRIES**

SAMPLE

AACE
INTERNATIONAL



AAACE® International Recommended Practice No. 112R-20

COST ESTIMATE CLASSIFICATION SYSTEM – AS APPLIED IN MAINTENANCE TURNAROUND FOR THE PROCESS INDUSTRIES

TCM Framework 7.3 – Cost Estimating and Budgeting

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1. PURPOSE

As a recommended practice (RP) of AACE International, the *Cost Estimate Classification System* provides guidelines for applying the general principles of estimate classification to project and maintenance turnaround cost estimates (i.e., cost estimates that are used to evaluate, approve, and/or fund projects or turnarounds). The *Cost Estimate Classification System* maps the phases and stages of cost estimating together with a generic scope definition maturity and quality matrix, which can be applied across a wide variety of industries and scope content.

This recommended practice provides guidelines for applying the principles of estimate classification specifically to maintenance turnarounds for the process industries¹. It supplements the generic cost estimate classification RP 17R-97 [1] by providing:

- A section that further defines classification concepts as they apply to turnarounds in the process industries.
- A chart that maps the extent and maturity of estimate input information (turnaround preparation & planning definition deliverables) against the class of estimate.

As with the generic RP, the intent of this document is to improve communications among all the stakeholders involved with preparing, evaluating, and using turnaround cost estimates specifically for the process industries.

The overall purpose of this recommended practice is to provide the process industry with a turnaround definition deliverable maturity matrix that is not provided in 17R-97. It also provides an approximate representation of the relationship of preparation & planning input data and scope definition maturity to the estimate accuracy and methodology used to produce the cost estimate. The estimate accuracy range is driven by many other variables and risks, so the maturity and quality of the scope definition available at the time of the estimate is not the sole determinate of accuracy; risk analysis is required for this purpose.

This document is intended to provide a guideline, not a standard. It is understood that each enterprise may have its own project and estimating processes, terminology, and may classify estimates in other ways. This guideline provides a generic and generally acceptable classification system for the process industries that can be used as a basis to compare against. This recommended practice should allow each user to better assess, define, and communicate their own processes and standards in the light of generally accepted cost engineering practice.

2. INTRODUCTION

For the purposes of this document, the term *process industries* is assumed to include firms involved with the manufacturing and production of chemicals, petrochemicals, hydrocarbon processing, energy, and utilities. One common thread among these industries is the continuous operation (as opposed to batch operation) of their process plant, thus necessitating regular maintenance turnarounds. The other common thread (for the purpose of estimate classification) is their reliance on process flow diagrams (PFDs), piping and instrument diagrams (P&IDs), and electrical one-line drawings as primary scope defining documents. These documents are key deliverables in determining the degree of scope definition, and thus the extent and maturity of estimate input information.

For the purposes of this document, the term *maintenance turnarounds* refers to maintenance, inspection and minor upgrade/modification work carried out by the turnaround maintenance and inspection team during a planned, periodic (total or partial) shutdown of a process unit or plant.

Maintenance turnaround events (which are sometimes viewed as a short-interval project by contractors) typically

¹A turnaround (in the context of the process industries) is defined here as a planned, periodic shutdown (total or partial) of a process unit or plant to perform maintenance, overhaul and repair operations and to inspect, test and replace process materials and equipment. (Adapted from API definition.)

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also have traditional capital project tie-in scope which needs to be executed in the turnaround event window, as well as the standard inspection and maintenance scopes. The cost estimates covered by this RP are for the inspection and maintenance work only. RP 18R-97 [2] covers estimates for the traditional project scope that may be executed during the same event window. (However, it should be noted that executing traditional capital project scope during a turnaround affects the estimate of both the traditional project and the turnaround itself. Consequently, this guide makes reference to the status of the capital projects integration plan and to the status of capital project engineering packages as part of the estimate class discussion.)

To explain further, this RP applies to corrective maintenance, preventive maintenance, inspection work (statutory, regulatory, risk-based, company mandated, etc.) and minor “management of change” projects, if carried out by the maintenance team. It does not apply to capital investment project work, executed by a project team (either on-site or corporate), even if that project work requires a shutdown of the plant for installation of tie-ins. This excludes shutdowns for routine catalyst changes.

Examples of typical scopes for this RP include valve refurbishment, pipe clamp removal and pipe repair, repair of corrosion under insulation (CUI), overhaul of compressors to meet original equipment manufacturer (OEM) warranty requirements, cleaning of shell and tube heat exchanger tubes, replacement of heat refractory bricks in a reactor, repair/replacement of damaged trays in a distillation column, etc.

This RP applies to a variety of field execution contract payment methods, including reimbursable, unit rate and lump-sum. For the purposes of this document, the term *premise document* refers to a document produced in the early stages of preparation & planning for a turnaround. It explains the reasons for holding the turnaround, the objectives to be achieved by the turnaround (both in terms of improved and more reliable operation and in terms of targets for the turnaround team) and, if written well, may also include clear scope inclusion criteria. Synonyms for the term premise document include scoping document and business objectives document.

This guideline reflects generally accepted cost engineering practices, including those outlined in the *Total Cost Management (TCM) Framework* [3] and uses standard AACE terminology. [4] This recommended practice was based upon the practices of a range of companies in the process industries from around the world, as understood by a range of AACE contributors. It also encompasses a literature search of published references and standards on estimate classes for turnarounds, but only one was found in the public domain. [5] Company and public standards were solicited and reviewed, and the practices were found to have significant commonalities. These classifications are also supported by empirical process industry research of systemic risks and their correlation with cost growth. [6]

3. COST ESTIMATE CLASSIFICATION MATRIX FOR MAINTENANCE TURNAROUNDS IN THE PROCESS INDUSTRIES

A purpose of cost estimate classification is to align the estimating process with the turnaround stage-gate scope development and decision-making processes. It should be recognized that the maintenance turnaround world has not universally accepted the concept of stage gates in front-end definition as widely as the capital project world. In capital projects, the length of each stage is a function of the work required to be completed in that stage. The culmination of each stage is a cost estimate, with the estimates getting more accurate with each succeeding stage as risks are treated. Differences from the system used for capital projects include the fact that the length of each stage is (more or less) fixed, based on the amount of time remaining until the turnaround starts. It is not dependent on how far preparation and planning have progressed.

Table 1 provides a summary of the characteristics of the five estimate classes. This matrix in Table 1 and the guidelines in Table 2 outline an estimate classification system that is specific to maintenance turnarounds in the process industries. Refer to Recommended Practice 17R-97 for a general overview of estimate classes, or to other