The National Institutes of Health | Division of Technical Resources | Office of Research Facilities

Design Requirements Manual **News to Use**

November 2018

Vol. 02, No. 23

The formulae $\frac{\partial \rho U_i}{\partial t}+\frac{\partial}{\partial x_j}(\rho U U_j)=-\frac{\partial P}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial U_i}{\partial x_j}\right)+g_i(\rho-\rho_0)$ for building $\frac{\partial}{\partial x_j}(\rho\overline{U}\overline{U_j})=-\frac{\partial\overline{P}}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial\overline{U_i}}{\partial x_j}-\rho\overline{u_i'u_j'}\right)+g_i(\rho-\rho_0)$ state of the art $\frac{\partial}{\partial x_i}(\rho\overline{U}\overline{H})=\frac{\partial}{\partial x_i}\left(\lambda\frac{\partial\overline{T}}{\partial x_i}-\rho\overline{u_i'h'}\right)$ biomedical research facilities.

Quality Assurance and Quality Control

Appendix E of the DRM, A/E Submission Requirements, outlines the content and quality requirements for design document submissions. To meet these requirements it is necessary for the A/E to utilize Quality Assurance (QA) and Quality Control (QC) procedures. QA and QC are separate and distinct activities, both of which are necessary to ensure the quality of an end product, including design documents and construction.

QA is the conscious planning and implementation of systems and procedures to ensure that a process is carried out with a high probability of success. QA is typically proactive, and begins at the onset of a process. QA focuses on failure prevention.

QC is the systematic checking of an end product to identify failures and either correct or eliminate them. QC is typically reactive, and conducted at the end of a process. QC focuses on failure detection.

QA and QC During Design

It is required that a designer produce high quality construction documents, which the Construction Specification Institute defines as "clear, concise, correct and complete."[1] A QA process should address the specific complexity, scope, and requirements of a project. The process must include appropriately qualified and experienced staff, thorough understanding of requirements and regulations, progress and coordination meetings and 'lessons learned' from other projects, review comments, and QC feedback. QA may also include peer and constructability reviews, checklists, standards and templates, and other quality-driving tools.

The QA process ensures that the documents produced are of high quality. Some errors are inevitable, however, and the QC process is required to identify those errors so that they can be corrected. A designer's QC process must include a review of all documents (BOD, drawings, and specifications) by an experienced interdisciplinary QC team. The QC team should check documents for accuracy, coordination, completeness, constructability, and compliance with regulatory and contractual requirements. The QC team must have the authority to delay the issuance of documents until they have certified that quality standards have been met. The QC team should report deficiencies so that they can be addressed in an improve QA process.

QA and QC During Construction

The definition of 'quality' of construction can vary by project. Generally, it means meeting project parameters (such as cost, schedule, and contractual and regulatory requirements), avoiding disputes, meeting the design intent of the construction documents, and producing a facility that meets the owner's expectations and performs as intended.

Every project should have a written QA plan which outlines the required processes, standards and policies. The QA plan must define the efficient and organized management of all aspects of the construction process, including personnel, information and documentation, site, regulations and approvals, schedules and budgets. Personnel roles and responsibilities must also be defined, including responsibilities for safety, communication, coordination and quality. Processes for inspections and observations, and for reporting unacceptable work or activities, including remedial actions, must be defined

QC involves testing and inspecting the work being installed. A QC manager must be identified who is independent of the project superintendent, and who has the authority to accept or reject work. Inspections and testing by the contractor, subcontractors, and government should be performed at required times, and results should be provided to the QC manager without delay so that corrective actions can be taken if necessary. All actions should be communicated and documented.

Conclusion

A high level of quality is the objective of every design and construction project; if a design submission or element of the built work is rejected, the schedule and budget of the project will be negatively impacted. The effort that goes into QA and QC acts as insurance against the cost of delays, disputes and damaged reputations caused by quality failures.

References

[1]CSI Construction Product Representation Practice Guide

'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'. **Please address questions or comments to:** shawm@nih.gov

Further details on this month's topic are available on the DRM website: Appendix E
https://www.orf.od.nih.gov/PoliciesAndGuidelines/Pages/DesignRequirementsManual2016.aspx