

Best Practice #35

Facility: Oak Ridge National Laboratory

Best Practice Title: Building Commissioning for Non-Nuclear Facilities

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Brief Description of Best Practice:

Building commissioning is a tailored systematic process for achieving, verifying, and documenting that the non-nuclear facility and its systems, subsystems, and equipment are planned, designed, installed, and tested, and are capable of being operated and maintained according to the Owner's Project Requirements (OPR). (For nuclear projects the Startup Readiness process in DOE O 425.1C applies.) Building commissioning is being utilized as a broader and focused activity in the commercial building process. Commissioning in a graded approach may begin early in the planning/design phase and be carried through the post occupancy period. Commissioning is being integrated into the construction process to ensure that owners and investors get good buildings for their investments. It is a method of risk reduction for new construction projects or major capital improvements and it is a comprehensive way to assess and tune up performance of existing buildings. Building commissioning for new buildings “focuses on verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated and maintained to meet the owner’s project requirements”¹ According to the General Services Administration, “Commissioning for existing buildings identifies causes and recommends solutions to typical problem areas such as high energy costs and poor comfort or indoor air quality. The commissioning agent and team can be comprised of varying participants depending upon scope, complexity and budget of the project. Commissioning (or Re-Commissioning which occurs, generally a year after initial Commissioning and annually thereafter) is applicable throughout the lifecycle of a building to assure that the building is built and operates as intended. This assurance is needed not only at the beginning of a building's life (i.e. design and construction) but also when any renovation work occurs as well as periodically during the on-going operation of a building.

Why the Best Practice was used:

To ensure efficient buildings are delivered to owner’s requirements. Overall the Building Commissioning process is intended to smooth the building turnover process, realize energy savings; assure indoor air quality; improve system function, operation and maintenance and increase thermal comfort. Key elements of a comprehensive Building Commissioning Plan include:

Documentation of Operational Program Requirements as well as Operating Sequences

Verification of systems performance based on Design Intent Document(which should also contain postulated upset conditions) and documented by functional testing and measurement

Preparing and submitting O&M manuals and the training of building operations staff on system operations and maintenance procedures.

Ongoing monitoring of system performance(With modern Building Automation Systems[BAS])

¹ ASHRAE Draft Guideline 0-2003

the monitoring occurs through monitoring & logging of critical system performance parameters and “off normal” situations are noted real time for correction by the operations staff).

What are the benefits of the Best Practice?

- § Fewer change orders during the construction process
- § Fewer call-backs
- § Long-term tenant satisfaction
- § Lower energy bills
- § Avoided equipment replacement costs
- § Improved operating margins for building owners once the building is occupied
- § Assures building’s operational staff is properly trained
- § Operations and maintenance manuals are compiled correctly at project turn-over.
- § Aids in completing project management/operational requirements such as project reviews and Operational Readiness Reviews
- § A fully functional building at first occupancy (within warranty)
- § Safer and more comfortable building
- § Fewer disputes between building owner and General Contractor
- § Discovery of problems earlier in the process when they are less expensive to correct

Owner commitment to the process is extremely important and must be explained to all parties and stakeholders. Without a firm understanding of responsibilities the process can falter.

What problems/issues were associated with the Best Practice?

A well planned approach should be formulated in the early planning stages of the project to determine the extent to which commissioning will be employed. Once this decision is made adequate resources need to be committed. One key aspect of the commissioning process is to establish a clear understanding by all parties involved of the roles and responsibilities of the various participants including the owner, commissioning agent, A/E, other design support, construction contractors, and the future building/system maintenance staff. Each play a pivotal role in the commissioning process and their actions or inactions can have an impact on the process. Owner commitment to the process is extremely important and must be explained to all parties and stakeholders. Without a firm understanding of responsibilities the process can falter. Identifying resources both in-house and subcontracted that brings expertise to the process. In house resources must be convinced the commissioning process adds value compared to what has been done in the past.

How the success of the Best Practice was measured:

At ORNL, commissioning is a new tools/process being deployed in various levels. Success is measured in a qualitative manner. Projects which have utilized commissioning have experienced smoother transitions between construction and operations and have provided operational maintenance staff with a complete package of system documentation. In some cases the use of an independent commissioning agent has help construction contractors to improve construction quality.

Description of process experience using the Best Practice:

At ORNL a form of commissioning on facility related construction projects utilizing in-house project, design and construction management staff has always been performed. The process however did not have the overarching coordination now being deployed in most commissioning efforts. In prior efforts the design staff and construction staff provided quality assurance, quality control, design and construction surveillance.

ORNL has six major construction efforts underway or recently completed which utilized some form of commissioning. Each of these projects tailored the commissioning effort to fit both the scope and budget of the project. Most of the projects utilized a contracted commissioning agent during some phase of the project. On one project, the commissioning effort is being performed by an in-house commissioning team made up of a project manager (commissioning agent), disciplined design staff and construction field representatives. Web Publishing Information:

Please check (**highlight**) the applicable boxes below for the Topical Area(s) to which the Best Practice relates:

- Acquisition Management
- Assessments
- Cyber Security
- Energy Efficiency
- Engineering
- Environmental
- Information Management
- Information Security
- Integrated Safety Management
- Maintenance
- Management
- Material Control and Accountability
- Nuclear Safety
- Performance Metrics
- Personnel Security
- Physical Security
- Price-Anderson Amendments Act
- Project Management
- Protective Force
- S&S Program Planning and Management
- Standards and Requirements
- Subcontractor Safety
- Other

Please check the applicable box below for the Core Function and Guiding Principle to which the Best Practice relates

- Principle 1: Line Management Responsibility for Safety
- Principle 2: Clear Roles and Responsibilities
- Principle 3: Competence Commensurate with Responsibilities

- Core Function 1: Define Scope of Work ;
- Principle 4: Balanced Priorities
- Core Function 2: Analysis of Hazards
- Core Function 3: Develop and Implement Hazard Controls;
- Principle 5: Identification of Safety Standards and Requirements;
- Principle 6: Hazard Controls Tailored to Work Being Performed
- Core Function 4: Perform Work Within Controls;
- Principle 7: Operations Authorization
- Core Function 5: Provide Feedback and Continuous Improvement