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**DOE H 413.X-XX**

**Commissioning and Startup Handbook**

*This Handbook describes suggested non-mandatory approaches for meeting requirements. It captures lessons learned and best practices from DOE and Industry as related to commissioning and strartup of nuclear facilities. Handbooks are not requirements documents and are not to be construed as Requirements in any audit or appraisal for compliance with the parent Policy, Order, Notice, or Manual.*



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**Oversight & Assessments**

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**Commissioning –** The phase of a project between construction and operations which includes testing to demonstrate functional and performance requirements are met and that personnel, programs, and facilities are ready to enter the operational phase. Commissioning includes achieving CD-4 in accordance with DOE O 413.3B and readiness verification in accordance with DOE O 425.1D or equivalent, but may extend beyond CD-4 based on the specific contract.

**Commissioning Plan** - A document developed by the Commissioning Authority establishing commissioning strategies, sequence, schedule, and resources for the commissioning phase of a project, and for identifying system design capabilities in support of commissioning. The Commissioning Plan is typically developed early in a project with high level information and updated with more detail as the project progresses. See DOE O 413.3B and DOE G 413.3-16A for additional information.

**Commissioning Authority** - The responsible individual with responsibility for developing and maintaining the commissioning plan and for supporting design and construction activities as a primary stakeholder representing commissioning phase interests. See DOE G 413.3-16A for additional information.

**Commissioning Programs** - Programs developed to specifically support the commissioning phase of a project as differentiated from construction phase programs.

**Construction complete** – The stage of construction completion where the construction is sufficiently complete to warrant recognition. Typically, does not mean that construction is literally done, and is likely to include specific exclusions or remaining minor construction activities.

**Construction testing** – Testing performed by the construction organization prior to system turnover to a commissioning phase organization. Typically includes hydrostatic testing, flushing, wiring continuity checks, non-destructive weld examination (radiography, dye penetrant, ultrasonic, etc), and similar construction phase testing.

**Component Testing (grooming)** - Testing performed at the component level to ensure that components are: 1) properly installed; 2) are in serviceable condition and; 3) are setup to support system level testing.

**System Testing** – Testing done with integrated sets of components at a system or subsystem level to demonstrate that functional and performance requirements are met, for example: cooling loop flow/pressure balance, interlock and control logic verification, transfer pump performance, safety function response time, etc.

**Generic testing** – Testing done in accordance with pre-approved test procedures which are standardized to be applied without modification to a class or category of components. These are typically used for component level testing.

**Facility Testing** – Testing done at with groups of systems to demonstrate facility level requirements such as product qualification, emissions and regulatory requirements, production capacity or throughput, and key performance parameters.

**Pre-Commissioning** – Commissioning phase component, system, and facility testing completed using air, water, and standard industrial hazards to prepare for cold commissioning.

**Cold commissioning** – Commissioning phase testing and operator proficiency activities completed with non-radioactive chemical simulant materials in order to demonstrate requirements are met prior to introducing radioactive materials or hazards.

**Hot commissioning** – Commissioning phase testing or operator proficiency activities completed using radioactive or full hazard materials to demonstrate facility capability prior to entering the operational phase.

**Design Verification** – The process of ensuring that traceable activities demonstrate design requirements are met through analysis, inspection, testing, or other specified approach.

**Constructability** – The ability of a design to be constructed using preferable fabrication, construction, or field deployment techniques.

**Operability** - The ability of a design to safely perform it’s intended operational function within the capabilities and resources of the operating organization. See DOE O 420.1B for more information.

**Maintainability** – The ability of a design to be safely maintained in accordance with requirements within the capabilities and resources of the maintenance organization and with minimal impact to production. See DOE O 420.1B for more information.

**Testing requirements** – Design verification requirements established by the responsible design organization in order to establish that design, regulatory, and contractual requirements are met through testing or demonstration of components, systems, or facilities. See DOE STD 1073 and DOE O 420.1B for more information.

**Key Performance Parameters** – A measurable performance goal that a given technology should attain to enable mission objectives (DOE G 413.3-4)

**Readiness strategy** – A sequence of actions, activities, and deliverables needed to support both Department of Energy (DOE) directive DOE O 425.1D, *Verification of Readiness to Start Up or Restart Nuclear Facilities* (DOE O 425.1D), Attachment 1, “Contractor Requirements Document” (CRD) core requirements that are associated with the seven principles of Integrated Safety Management System (ISMS) and DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, Appendix A, *Requirements*, Table 2.4, *CD-4 Requirements*.

**Facility Readiness Plan** - The facility readiness plan is the combination of the activities need to attain operational readiness and the associated objective evidence requirements.

**Readiness verification** – the process of establishing by either compliance or performance based means that an activity, operation or facility has achieved an adequate state of readiness.

**Hazard Category** - The consequences of releases of radioactive or hazardous material are evaluated as required by 10 CFR 830 and classified by the following hazard categories:

a. Category 1: The hazard analysis shows the potential for significant off-site consequences.

b. Category 2: The hazard analysis shows the potential for significant on-site consequences.

c. Category 3: The hazard analysis shows the potential for only localized consequences.

DOE-STD-1027-92, *Hazard Categorization, and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, Change Notice 1, contains additional informationon methods and criteria for determining Hazard Categories. [DOE-STD-3006-2010]

**Hazard Analysis Report** – A documented analysis of facility hazards and identification of hazard control requirements. Hazard analysis reports may be graded based on the specific hazards of the facility including implementation of DOE O 3009 requirements for nuclear facilities.

**Authorization agreement** - A documented agreement between the DOE and the contractor for high-hazard facilities (Categories 1 and 2), incorporating the results of DOE's review of the contractor's proposed authorization basis for a defined scope of work. The authorization agreement contains key terms and conditions (controls and commitments) under which the contractor is authorized to perform work. Any changes to these terms and conditions would require DOE approval.

**Authorization Basis** - Those aspects of the facility design basis and operational requirements relied upon by DOE to authorize operation. These aspects are considered important to the safety of facility operations. The authorization basis is described in documents such as the facility Safety Analysis Report and other safety analyses; Hazard Classification Documents, the Technical Safety Requirements, DOE-issued safety evaluation reports, and facility-specific commitments made in order to comply with DOE Orders or policies.

**System Turnover** – The transfer of jurisdictional control of a system from one organization to another, typically part of the phased transition of a project from construction through commissioning and into operations.

**Management Self Assessment** - An evaluation of management programs, systems and processes to assess their adequacy and effectiveness. Based on performance result, it is used to determine how well management is providing the leadership to enable an organization to continuously meet requirements and expectations. The purpose of a management assessment is to identify strengths and weaknesses affecting the achievement of organizational objectives so that meaningful action can be taken to improve the opportunity for success. Management assessments of processes typically are comprehensive (from cradle to grave) and cross organizational boundaries. Management assessments evaluate the adequacy of the current approach and always question if a significant process change would be more efficient/ effective

**Readiness Review** - A review conducted to determine readiness to startup or restart a nuclear

facility, activity, or operation. There are two types of RRs: ORRs and RAs. [DOE-STD-3006-2010]

Contractor Operational Readiness Review - A disciplined, systematic, documented, performance-based examination of facilities, equipment, personnel, procedures, and management control systems for ensuring that a facility can be operated safely within its approved safety envelope as defined by the

facility safety basis plan. The ORR provides the basis for the Department (DOE) to direct startup or restart of the facility, activity or operation. [DOE O 413.3B]

DOE Operational Readiness Review - A disciplined, systematic, documented, performance-based examination of facilities, equipment, personnel, procedures, and management control systems for ensuring that a facility can be operated safely within its approved safety envelope as defined by the facility safety basis plan. The ORR provides the basis for the Department (DOE) to direct startup or restart of the facility, activity or operation. [DOE O 413.3B]

**Plan of Action** - The document prepared by line management that describes the scope of the RR, the prerequisites to be met to begin the RR, and the proposed team leader for the RR. The contractor and DOE both prepare POAs for their respective RRs (in some instances as specified in the SNR, a DOE RA may not be required). Both contractor and DOE POAs when required are submitted to the SAA for approval. The designated RR team leader(s) develops their IP from the approved POA. [DOE-STD-3006-2010]

**Start-up Notification Report** - A semi-annual report as designated by the PSO) by each

responsible contractor to identify nuclear facility new starts and restarts scheduled in the next year. The report identifies the facility and, based on the criteria in DOE O 425.1D, specifies whether an ORR or a RA is required. The SNR also identifies the SAA and updates previously provided information. [DOESTD-3006-2010] Care, Custody and Control

**Independent Verification Review (IVR**) - A formalized verification of the completeness and adequacy of the implementation of the safety basis (DSA and TSRs) for a nuclear facility. A successful IVR, including the resolution of all pre-start issues, may be a prerequisite to the start of an RR as defined in DOE O 425.1D. [DOE-STD-3006-2010]

**Punchlist** – A list of incomplete items or activities maintained through the system turnover process to ensure that they are tracked to completion.

**System/Sub-System** – a group of components that work together to provide a required function or capability. Typically, components forming a system are identified through the design process and share a designation to maintain association in design, installation and testing activities.

**Turnback** - – The process of performing system turnover activities to return a previously completed system or sub-system to Construction for major rework or modification.

**Design Authority** – The organization responsible for establishing and maintaining the design requirements, ensuring that design output documents accurately reflect the design basis, and maintain design control and ultimate technical adequacy of the design process (DOE STD 1073)

**Design Agency** – The organization responsible for developing design outputs implementing requirements established by the design authority.

**Facility Manager** - – Line manager responsible for safe facility operation and maintenance.

**Test Deficiency Report** – A document produced to record the inability to perform a test step or that the results of a test step failed to meet specified criteria. Test Deficiency Reports are used to document testing issues and track the development and implementation of corrective actions.

**Test Change Request Request** – A document produced to identify and approval of a change to an approved test procedure.

**Readiness to Proceed Memo (Declaration of Readiness to Operate**)- The formal document submitted by the contractor which certifies the conclusions that the facility is prepared to start or resume operations. The Readiness to Proceed Memorandum documents: Certification the activity is ready to start, Closure of pre-start actions for pre-start findings, and CAPs. The memorandum may include specific items requiring completion or resolution prior to the resumption of program work.

**Declaration of Readiness**- The Declaration of Readiness formally documents the responsible line management’s certification that readiness to start operations has been achieved and the prerequisites specified in the POA have been met. It includes the results of the RSA/MSA including resolution of identified issues and, if needed, documents a manageable list of open items.

**Decommissioning**- The sequential phases for a facility, once a shutdown decision is made by DOE-HQ, through facility transition, surveillance and maintenance, and facility dispositioning.

**Deactivation** \_The activities associated with removing facility systems and/or area from operational service with the intent of being ready for facility transition to either convert the facility for another use or permanent shutdown

**Decontamination**- Process of removing radioactive contamination and materials from personnel, equipment, or areas

**Operational Acceptance**- Identification of the documentation required for turnover of new or modified systems, structures, and components (SSCs) to the operating entity to support startup, operation, and maintenance.

**Post Repair Testing**- A test that is performed on structures, systems, and components to determine whether corrective maintenance, preventive maintenance, modification, testing, or troubleshooting activities have affected the ability of the equipment and its associated interfaces/equipment to perform their intended function. In the case of corrective maintenance, a post maintenance test also verifies that the maintenance action has properly corrected the identified deficiency

**Joint Test Group**- A group of appointed representatives who review the test documents prepared by the engineering, procurement, and construction activity testing organization and provide approval and acts as the Test Authority for the activity