Transitioning from Construction to Startup at WTP from a Plant Engineering Perspective – 16461

Ryan M. Covert[*], Jeffrey R. Markillie[*], David I. Green[*], Steven P. Churchill[*], Roger A. Wahlquist[*], Gregory D. Laine[*], Ronald J. Nargi[**]

[*] URS-AECOM, Richland, WA 99354
[**] Bechtel National, Inc., Richland, WA 99354

ABSTRACT

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) is a one-of-a-kind facility being designed, built and commissioned for the U.S. Department of Energy by Bechtel National, Inc. and principal subcontractor URS to solidify liquid radioactive waste stored in underground tanks at the Hanford Site.

WTP consists of 20 infrastructure facilities and structures, known as Balance of Facilities, designed to support the Plant's four major facilities – Pretreatment Facility, High-Level Waste Vitrification Facility, Low-Activity Waste Vitrification Facility and the Analytical Laboratory. As construction moves toward startup and commissioning, a turnover process facilitates the transition of facilities and systems between organizations. The transition from Construction is initiated by an approved Design Completion List, which documents that design and construction have been completed, and the facility or system is ready for startup testing. Qualified individuals perform an inspection to ensure the facility or system has been constructed per the design during an eight-week engineering walkdown. During this phase in turnover, Plant Engineering personnel are responsible for updating and maintaining the Master Equipment List, developing spare parts recommendations, developing and issuing instrument calibration datasheets, evaluating temporary modifications, and supporting plant operations and maintenance activities. As of 2015, two electrical switchgear buildings and the non-radioactive liquid waste disposal system have been turned over from Construction to Startup. This paper discusses the turnover process, organizational interfaces, and experiences from a Plant Engineering perspective.

INTRODUCTION

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) is being designed and constructed by Bechtel National, Inc. (BNI) for the U.S. Department of Energy (DOE). URS serves as the principal subcontractor for commissioning systems turned over from BNI. URS is organized into several groups, such as; Plant Operations, Plant Engineering, Facility Acceptance/Transition, Maintenance, Training and Procedures. Each organization plays a role in the turnover sequence.

The WTP Startup organization divides each process and support system into turnover scoped systems to more easily manage the turnover of systems, design documentation, and turnover deliverables to Startup and Operations. A single WTP system may be divided into several startup scoped systems,

depending upon its complexity and size. When design documentation and construction are completed for a scoped system, a two-step turnover process is initiated as shown in Figure 1.

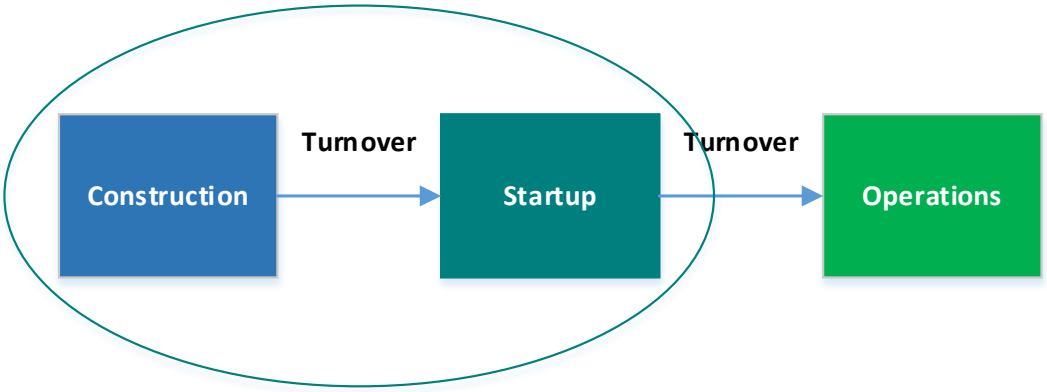

Fig. 1. Organizational Turnover Sequence

The first step in the turnover process is from Construction to Startup. The second step is turnover from Startup to Operations. Figure 2 shows a more detailed representation of what is included in the first turnover. A series of design-completion and construction-completion evaluations are performed to ensure design requirements have been properly incorporated into the detailed design and the as-constructed system accurately implements the design. Discrepancies are placed on the work-to-go list, and resolved before the 8-week walkdown. The 8-week walkdown is then performed as a method for inspecting the system, again to ensure the as-constructed system accurately implements the design. It is performed eight weeks before the planned turnover date from Construction to Startup, and provides a two-month period to resolve construction or design discrepancies. The remainder of this paper is focused around and after the 8-week walkdown from a Plant Engineering perspective.

Fig. 2. Turnover Items from Construction to Startup

TURNOVER ACTIVITIES

There are a number of planning activities that are undertaken prior to initiating turnover, including the scheduling of turnover deliverables. The following sections describe the detailed planning that is performed, and many of the deliverables that are prepared.

Turnover Planning/Scheduling

Approximately six months before turnover begins, the Facility Acceptance/ Transition (FA/T) team develops the detailed turnover schedule. This schedule identifies the critical activities required to be performed by the operations organizations (Plant Operations, Plant Engineering, Maintenance, Training and Procedures) to support system turnover from Construction to Startup, startup testing, and turnover from Startup to Plant Operations. A standard schedule consists of approximately 40 activities per scoped turnover system, including preparation of key deliverables such as: the Master Equipment List, preventative maintenance task forms, maintenance work packages, system alignment checklists, system operating manual, operator training materials, spare parts recommendations, and applying permanent plant labels.

Turnover schedule meetings are held regularly among the activity owners to assess progress and resolve issues. The turnover meetings are led by a FA/T turnover specialist and includes participation of staff from Plant Operations, Plant Engineering, Maintenance, Training and Procedures. The FA/T turnover specialist ensures activities are completed as scheduled and documented for evidence of completion. As issues arise, the specialist acts as an interface between organizations (internal and external) to assist in resolving issues preventing completion of activities. The FA/T turnover specialist interfaces with the Construction/Startup turnover manager, Design Engineering, Construction, and Startup reporting schedule status, completion of activities, and issues. Further, this individual reports the status of activities to line management to ensure visibility is maintained.

Plant Engineering is responsible for completing several of these tasks, as well as providing technical expertise on other tasks assigned to Plant Operations, Maintenance, or Training and Procedures. Many of these tasks are outlined in facility procedures, such as 24590-WTP-GPP-MGT-042, *WTP System Turnover* [1], and will be discussed in further sections.

Establish Master Equipment List

The WTP contract requires the development of a Master Equipment List (MEL) "…developed in an electronically sortable format with sufficient information to provide traceability to the WTP design, sufficient information to procure qualified spare parts, and linkage to preventative and corrective maintenance records..." Section 3, Standard 3 [Std. 3 (c)(6)(i)]. This deliverable is the responsibility of the Contractor with a Contract due date prior to the completion of the Operation Readiness Review. In order to ensure each component is properly identified, the MEL is established for each scoped turnover system as part of the turnover process.

Currently, the Computerized Maintenance Management System (CMMS) is used to house the MEL. CMMS stores key information about each individual component tag number, and links each component to its corresponding maintenance activities. Each tag has its own associated MEL information (component tag number, originating design document, product defining document, quality level, safety classification, seismic category, dangerous waste permit, and SSC characteristic) stored in CMMS.

Prior to turnover to Startup, Plant Engineering is responsible for developing, verifying, and implementing the MEL for a given startup code into CMMS. Using 24590-WTP-GPP-CMNT-012, *CMMS Equipment Database Change Control Management/Administration* [2], and CCN 260974, *Master Equipment List (MEL) Validation Desktop Instructions* [3], the Plant Engineer develops the MEL for the system of interest, and ensures its implementation into CMMS. Most of this work is completed prior to the 8-week walkdown, but all component tag numbers must be locked down in CMMS MEL by turnover to Startup.

Identify and Procure Spare Parts

The contract requires a Spare Parts List be established to support Operations. Development of the Spare Parts List is to be performed by:

(A) "Assessment of the mean time before failure of equipment as identified by the Operational Research Assessments (Standard 2, Deliverable 2.5); and

(B) Assessment of the time required to procure and modify replacement equipment.

(C) Ensuring that the spare parts list supports WTP operations for one (1) year following completion of Hot Commissioning." Section 3, Standard 3 [Std. 3 (c)(6)(ii, iii, iv)].

Further, the contract requires the Spare Parts List to be turned over to the operations contractor prior to project closeout. The Spare Parts List, and basis, is to be provided to DOE for review and comment.

Plant Engineering, for a particular startup scope, is responsible for recommending the spare parts to be held in inventory for the system. Once a list of spare parts has been recommended (in accordance with 24590-WTP-GPP-MGT-045, *Spare Parts Management* [4]), the Spare Parts Coordinator (SPC) reviews the list and deems it procedurally correct. The Plant Engineer then issues the document in Project Document Controls.

The SPC then catalogs the spare parts identified on the Spare Parts Recommendation List into CMMS and proceeds to generate a Field Material Request (FMR) in accordance with 24590-WTP-GPP-CON-7111, *Field Material Requisitions* [6]. The FMR is then issued for approval, which begins the procurement cycle.

The Field Procurement team issues the FMR for bids. Once the bids come back, Procurement awards a purchase order based upon those bids and expedites the order until delivery. Delivery typically is made to the construction site where the SPC generates a Material Withdrawal Request so the material can be received and stored by the Materials group.

Typically, Plant Engineering has divided spare parts recommendations (within a given startup code) into mechanical, electrical/controls, fire detection and alarms, and process control systems to simplify development of spare parts recommendations. Also, by breaking down the recommendations, plant

engineers of different disciplines can work on their respective portions of the system recommendation independently.

Evaluating Startup, Operations, & Maintenance Requirements

Prior to system turnover to Startup, the Plant Operation staff perform an evaluation of the system/components and their corresponding maintenance and operations requirements. The maintenance portion of this evaluation takes into consideration code and permit requirements and vendor manuals to determine required surveillances, calibrations and periodic maintenance. Along with the identified maintenance activities, periodicity of the maintenance activities also is defined. Once developed, Plant Engineering reviews the identified maintenance activities and frequencies. Plant Engineering can increase, decrease, or eliminate maintenance activities and frequencies based on past experience, location, cost and use of the component within the limits of requirements including codes, standards, permits, and safety basis. Plant Engineering provides justification if the activity frequencies are adjusted or eliminated. This evaluation is utilized by Maintenance work planners to develop required periodic maintenance packages and to import into the work control system recall frequencies of the maintenance activities.

Plant Operations also evaluates the system to determine the required operational, alarm response and abnormal operations procedures. Operations evaluates the required activities for startup, operation and shutdown of the system and documents what activities are needed to safely operate the system in all required modes of operation. Also, identified in this evaluation are the system alarms that will require a response by Operations. This part of the evaluation is provided to the Training and Procedures organization so they can develop required procedures to operate the system and training to support certification of operations personnel.

Plant Engineering assists Plant Operations and Maintenance in these endeavors by providing technical guidance regarding requirements for equipment maintenance or operational checks and actions after turnover. Typically, the post-startup planner writes periodic maintenance task forms and associated work instructions regarding required startup and operations activities for the associated system turnover. Plant Engineering approves these task forms in accordance with 24590-WTP-GPP-CMNT-004, *Periodic Maintenance and Surveillance Process* [6].

Develop/Issue Instrument Calibration Datasheets

Plant Engineering is responsible for developing the calibration data sheets for all instruments to be calibrated based on the Instrument Index prepared by the Design Agency. The Plant Engineering staff first develops a report to classify and determine calibration periodicities for applicable instrumentation. This report dictates what instrument calibration datasheets must be issued for a particular system. These calibration datasheets are then developed by the plant engineer. Workflow should follow procedure 24590-WTP-GPP-RAEN-EN-0014, *Essential Process Instruments and Non-Essential Process Instrumentation* [7].

Develop/Approve Temporary Modifications

Currently, temporary electrical power is provided to energize facility electrical components because the switchgear buildings have not yet been energized. When connecting permanent plant power supplies (for example, panels and transformers) from a temporary power source, this configuration needs to be documented and managed because the power supply differs from final plant design. This configuration is controlled through temporary modifications, which are issued in the project's Electronic Document Management System, and physically identified with a tag hung on the equipment temporarily being modified.

Plant Engineering is responsible for determining what temporary modifications are required to be removed or added prior to turnover. An example of a temporary modification to be removed would be removing temporary power from motor heaters. An example of a temporary modification required for startup would be bringing temporary power to a motor control center, or bringing temporary air supply for control valves. Temporary modifications are performed in accordance with 24590-WTP-GPP-RAEN-EN-0013, *Temporary Modification Control* [8].

Identify Conditions resulting in Abnormal Operating Restrictions/Limits

Many process and support systems are required to accomplish the overall mission of the project. Since turnover of systems occurs incrementally as discussed above, the systems may not be turned over completely as initially designed. Because of this, an evaluation for abnormal operations/limits for facilities operation must be performed on the system within the applicable turnover boundaries. This evaluation may identify new restrictions or limits not originally identified for the system when operating in its normal designed configuration. The restrictions or limits need to be identified and addressed during the interim between limited and full turnover of the system to maintain operations of the system in a safe and compliant manner with all applicable codes, permits and safety standards. These identified restrictions/limitations are fed to the training and procedures group to ensure our interim operating procedures address them. Plant Engineering also evaluates the scoped system turnover to ensure operations can still meet all applicable code and permit requirements for the system, operate the system safely and will not exceed any equipment/system specifications while operating the system in this interim configuration.

This task belongs to Plant Operations; however, Plant Engineering staff collaborate and provide technical guidance. This task develops information regarding how, if a part of a system is incomplete, or an interfacing system is incomplete, operability is limited after turnover, and before commissioning. An example of a conditions resulting in operational restriction would be the lack of the Interface Control Network control room once a system is turned over. Without this, the controls for a system are not able to be used, and therefore most testing cannot occur.

Acquire Standard Measurement & Test Equipment

Plant Engineering is responsible for determining what is required for the particular system in order to accurately maintain, monitor, and calibrate the equipment (24590-WTP-GPP-CMNT-007, *Area Operations M&TE Control* [9]). The Plant Engineering Control and Instrumentation team is responsible for this task. Procurement of the required measuring and testing equipment (M&TE) is performed by the Material Control team with input from Plant Engineering. An example of required M&TE would be a unit used to check and recalibrate pressure gauges.

Develop Preventative Maintenance Instructions

The Maintenance Planning team is responsible for the development of preventive maintenance work instructions based on input provided by Plant Engineering. Development of work instructions involves several phases including understanding the work to be performed, identifying hazards associated with the work, developing work instructions to perform the work while mitigating the hazards involved, ensuring the work instructions have necessary approvals (technically accurate and workable), ensuring workability via the change process, and when the work is complete, providing feedback and resolution to post-job comments and issues. Individual and group walkdowns are performed to ensure work is understood, hazards are identified, and proposed work steps can be performed as written. Technical manuals, consultations with engineering, and subject matter experts for example also are used as resources. Based on those walkdowns and resources, work instructions are finalized and sent out for approval from responsible organizations. Once approved, a work package is developed to contain all documentation required to perform the task. After the work is performed, the work package is reviewed for lessons learned, opportunities for improvement, or any comments that require attention of the planning group. Once addressed, any feedback coming from individuals is relayed back to them as to how it was addressed. Maintenance activities are tracked and recorded within CMMS including all documents and associated approvals.

Plant Engineering provides technical guidance to Maintenance when developing work instructions for post-startup preventative maintenance activities. Plant Engineering is responsible for reviewing the associated work instructions, and approving or rejecting them, based on the quality and technical accuracy of the work. Work instructions are developed and approved in accordance with 24590-WTP-GPP-WPHA-001, *Work Control and Work Packaging* [10], as well as interfacing references. It is shown to be advantageous for Plant Engineering to work with the Maintenance planner as the work instructions are developed, rather than rejecting the final product due to inaccuracies, and waiting for rework.

Develop Operating Procedures

Operations procedures are developed using industry best practices, specific design attributes, the operations and maintenance requirements evaluation, and the evaluation of abnormal operating restrictions and limits. Operating, alarm response and abnormal operations procedures utilize information from

the vendor, hazards analysis, and engineering documents to develop the procedures to support safe and compliant operation of the system. Also, information from applicable permits and codes are taken into consideration when developing the operating, alarm response, and abnormal response procedures to ensure the system is operated within acceptable limits.

Plant Engineering provides technical input to the procedures and provides review and technical justifications where needed. Plant Engineering also reviews the procedures against 24590-WTP-CPRO-ADM-0002, *Plant Operations Technical and Response Procedures Writer's Standard* [11].

Design Change Implementation and Closure

Once a startup system reaches the 8-week walkdown milestone, it becomes a controlled system. Meaning, any design changes made to the system are documented through a process known as a design change package (DCP) in accordance with 24590-WTP-3DP- G04T-00907, *Design Change Package* [12]. Plant Engineering is responsible for the closure of DCPs in accordance with 24590-WTP-GPP-RAEN-EN-0016, *Change Implementation and Closure* [13]. This allows Plant Engineering to control and manage changes to components that are locked down in the MEL.

During the DCP process, the author coordinates with other organizations to ensure the change is properly reviewed. For example, Mechanical Engineering will review changes to mechanical equipment; where Controls and Instrumentation will evaluate the changes to instruments or calibration datasheets. Further, a design change may affect an operating procedure step, a module in a training package, or the system alignment checklist. All impacts of a proposed design need to be identified prior to approving the proposed design and associated DCP. By having this evaluation performed by several organizations, it decreases the human error and ensures the technical accuracy of the change.

The DCP author can request closure and implementation of the DCP when all approvals have been made. Plant Engineering is responsible for DCP closure by ensuring the design has been implemented, and the associated documents (e.g., operating procedures, system alignment checklists, training, etc.) have been updated.

CONCLUSION

Turnover of systems from construction to Startup requires efforts from across the WTP operations organizations. Plant Engineering leads some tasks, provides technical input in others, but is involved throughout the process to ensure scoped systems are properly and efficiently turned over, and the configuration of the systems is managed.

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