Improved Management of the Technical Interfaces Between the Hanford Tank Farm Operator and the Hanford Waste Treatment Plant - 13383

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ABSTRACT

The Department of Energy (DOE) is constructing the Waste Treatment and Immobilization Plant (WTP) at the Hanford site in Washington to treat and immobilize approximately 114 million gallons of high level radioactive waste (after all retrievals are accomplished). In order for the WTP to be designed and operated successfully, close coordination between the WTP engineering, procurement, and construction contractor, Bechtel National, Inc. and the tank farms operating contractor (TOC), Washington River Protection Solutions, LLC, is necessary. To develop optimal solutions for DOE and for the treatment of the waste, it is important to deal with the fact that two different prime contractors, with somewhat differing contracts, are tasked with retrieving and delivering the waste and for treating and immobilizing that waste. The WTP and the TOC have over the years cooperated to manage the technical interface. To manage what is becoming a much more complicated interface as the WTP design progresses and new technical issues have been identified, an organizational change was made by WTP and TOC in November of 2011. This organizational change created a co-located integrated project team (IPT) to deal with mutual and interface issues. The Technical Organization within the One System IPT includes employees from both TOC and WTP. This team has worked on a variety of technical issues of mutual interest and concern. Technical issues currently being addressed include:

- The waste acceptance criteria
- Waste feed delivery and the associated data quality objectives (DQO)
- Evaluation of the effects of performing a riser cut on a single shell tank on WTP operations
- The disposition of secondary waste from both TOC and WTP
- The close coordination of the TOC double shell tank mixing and sampling program and the Large Scale Integrated Test (LSIT) program for pulse jet mixers at WTP along with the associated responses to the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2010-2
- Development of a set of alternatives to the current baseline that involve aspects of direct feed, feed conditioning, and design changes

The One System Technical Organization has served WTP, TOC, and DOE well in managing and resolving issues at the interface. This paper describes the organizational structure used to improve the interface and several examples of technical interface issues that have been successfully addressed by the new organization.

INTRODUCTION

The U.S. Department of Energy (DOE), Office of River Protection (ORP) is responsible for management and completion of the River Protection Project (RPP) mission, which comprises both the Hanford site TOC and the WTP. The RPP mission is to store, retrieve and treat Hanford's tank waste; store and dispose of treated wastes; and close the tank farm waste management areas and treatment facilities in a safe, environmentally compliant, cost-effective, and energy-effective manner. The purpose of the WTP is to treat and immobilize the waste generated from processing nuclear material at Hanford and currently stored in underground storage tanks. The WTP's Pretreatment facility will separate the tank waste into Low Activity Waste (LAW) and High Level Waste (HLW) portions that will be immobilized into glass in separate vitrification facilities to generate Immobilized LAW (ILAW) and Immobilized HLW (IHLW). In October 2011, at DOE request, BNI and WRPS jointly submitted a proposal that provides the RPP an integrated management and technical execution approach for waste feed delivery (WFD) and WTP startup. This approach is called "2020 Vision One System" (herein referred to as One System) [1].

The One System strategy is to assure successful completion of all activities necessary to achieve WTP initial plant operations, lower costs and risks, and support completion of the RPP mission. The overall objective of this strategy is to increase the combined focus on completion of key supporting work scope elements and to instill accountability for jointly delivering the One System.

The One System Technical Organization has addressed several technical issues since the group was formed, including work on waste acceptance criteria and waste feed delivery, evaluation of a single shell tank riser cut, evaluation of the fate of Technetium-99 in the WTP, disposition of WTP secondary waste, interface management, and flowsheet alternatives. These issues and work completed to date by the by One System Technical Organization is the subject of this paper.

ONE SYSTEM ORGANIZATIONAL OVERVIEW

In DOE's concurrent letters to WRPS and WTP [2][3] request for the 2020 Vision proposal, it was noted that "DOE has determined that the current TOC and WTP Contract provide the appropriate contract vehicles to create a "One System" model for the delivery of elements of the Tank Farms Project and WTP. The "One System" is intended to address waste feed delivery, feed stream characterization, and acceptance of WTP products as an integrated system leading to efficient, consistent waste feed, waste processing, and product delivery during operations." The new organization operates under a jointly issued charter [4] that outlines the scope, and roles and responsibilities of the IPT. Staff in the One System IPT are co-located and interactions between WTP and TOC are facilitated by non-disclosure agreements and a memorandum of understanding that provides information for sharing resources. The scope in One System derives from the parent organization; there is no new scope created for One System. The One System management team developed the following vision statement: "One System is a WTP and TOC

safety-conscious team that, through integrated management and implementation of risk-informed decisions and ***mission-based solutions,*** will enable the earliest start of safe and efficient treatment of Hanford's tank waste, to protect the Columbia River, environment, and the public." The overall organization is depicted in Figure 1.

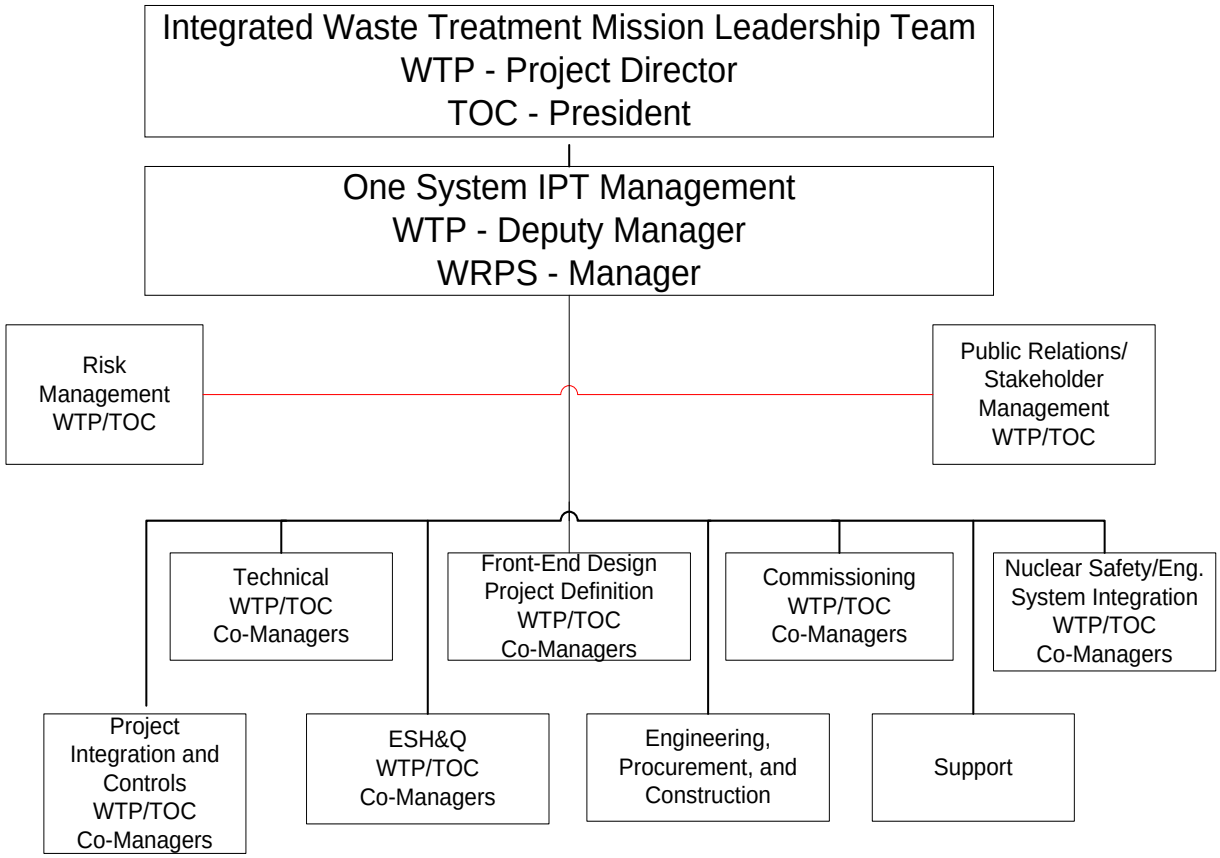

Fig. 1 One System Organization

The One System Technical Organization is comprised of the elements shown in Figure 2. There are on the order of 80 personnel assigned to this part of the One System Organization.

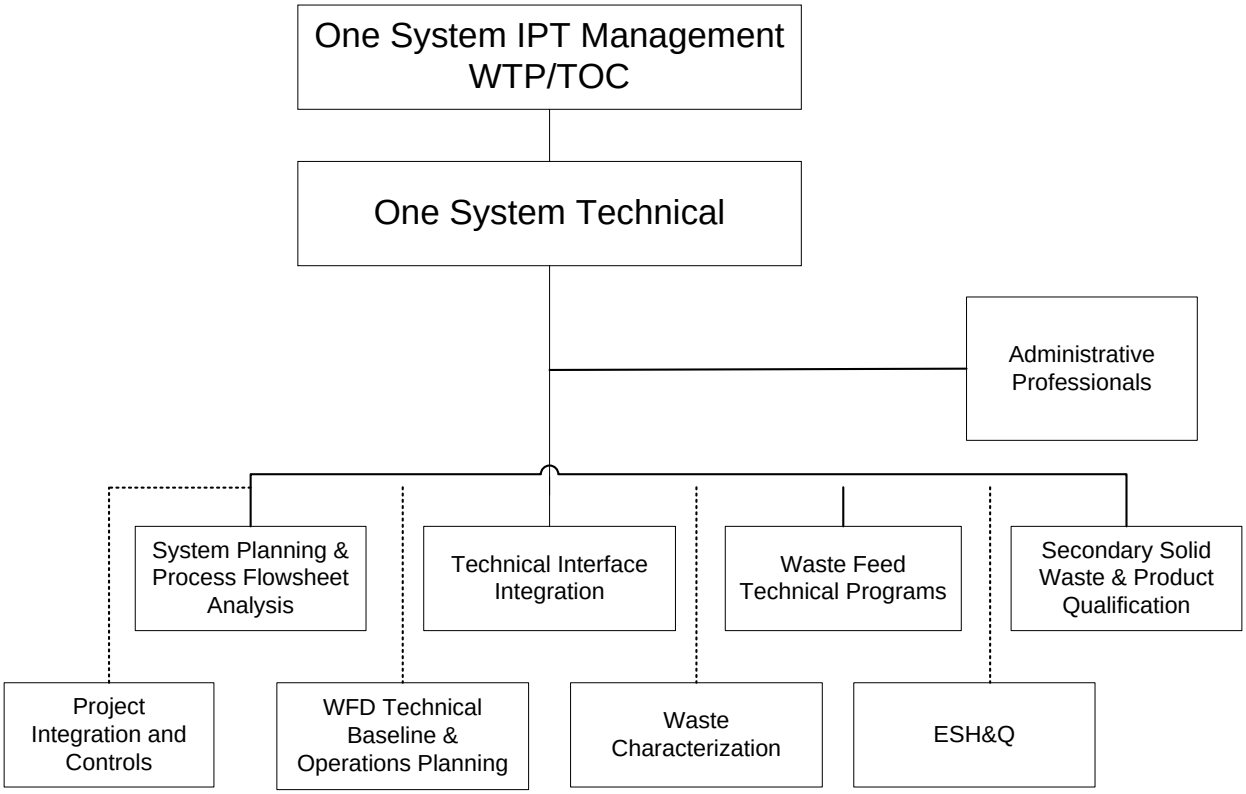

Fig. 2 One System Technical Organization

ONE SYSTEM TECHNICAL ISSUES MANAGEMENT

Management of Waste Acceptance Criteria and Waste Feed Delivery Issues

The waste acceptance criterion for WTP is contained in Interface Control Document (ICD) - 19 [5]. That document is produced by WTP, but is approved by WTP, TOC, and DOE. Currently the ICD lists some 15 open items that require resolution. A companion to ICD-19 is the initial data quality objectives (DQO) for the WAC [6] that was jointly developed by WTP and TOC. It also lists 15 open items. The ICD and DQO are managed within the Technical Interface Integration Group. There is a significant connection between the maturing of the WAC and finalizing the DQO (including potentially adding parameters that relate to WTP's ongoing program to address mixing, sampling, and transfer within WTP), as discussed in the following section on DNFSB Recommendation 2010-2. To coordinate and promote the timely resolution of the open issues in the ICD and DQO, One System has produced a plan [7] that will be implemented starting in early 2013.

Part of TOC's scope is to develop system plans and devise a waste feed delivery (WFD) approach [8]. This is carried out by the System Planning and Modeling Group of the One System Technical Organization which includes modeling staff from both TOC and WTP. This plan includes the sequence of deliveries to WTP over the mission along with the properties of each batch known as the feed vector. TOC evaluates the feed vector to ensure that the 600 or so batches meet the WAC. WTP also evaluates the feed vector to determine if there are any processing problems. Both modeling groups use Gensym's G2 dynamic model platform in these efforts, and there is collaboration on the model's input, bases, and assumptions. Efforts are underway to determine if there are efficiencies that can be realized given that both WTP and TOC use the same software platform, albeit with somewhat different structures.

Recently, DOE has confirmed that tank AY-102 is leaking [9]. This has ramifications for WTP as AY-102 was planned to be the source of hot commissioning feed for WTP, and had been characterized with that in mind. The decision-making process on how to respond to the leak is underway, and TOC is keeping WTP up-to-date on potential impacts to WTP via the One System organization. If the commissioning feed is changed, the WAC are unlikely to be affected, but TOC's plans for WFD system upgrades may be impacted, and additional glass formulation work may be necessary, including added characterization of a different commissioning feed.

Responding to DNFSB Recommendation 2010-2

The DNFSB issued its recommendation 2010-2 on pulse jet mixing at WTP in December, 2010 [10]. Sub-Recommendation 5 deals with representative samples for waste feed tanks. An implementation plan (IP) was developed to respond to the recommendations with a variety of deliverables and their associated delivery dates [11]. TOC One System personnel participated in the development of the plan. In particular, Sub-recommendation 5 involves 10 deliverables, 3 of which are co-authored by WTP and TOC, the balance are TOC products produced within the One System Technical Organization's Waste Feed Technical Programs Group. There is an additional jointly produced deliverable under Sub-recommendation 7 on interface management, and significant TOC and WTP involvement with a number of other deliverables.

To date a number of significant deliverables have been issued that involve the One System Technical organization input and review. Sub-recommendation 5 deals with topics on representative samples from waste feed tanks, Two jointly developed reports have been delivered to date for this sub-recommendation:

- Deliverable 5.5.3.1 is the initial gap analysis between WTP WAC and tank farm sampling and transfer capability [15]. Seven gaps and three open items were identified in this report. The most notable gap is TOC's capability to send large dense particles that are well beyond the WAC and the WTP design basis.
- Deliverable 5.5.3.2 is a report on the evaluation of waste transferred to WTP [14], that is, what are tank farms capable of sending to WTP. The conclusion is that TOC can deliver particles up to 3/8" diameter at a specific gravity of about 3, and 1000 micron particles at a specific gravity of 19 (corresponding to plutonium metal).

Future jointly-developed deliverables for Sub-Recommendation 5 include an update of the WAC based on LSIT results, a final gap analysis, and issuing an optimized DQO.

Sub-recommendation 7 addresses technical and safety-related risks

- Deliverable 5.7.3.1 is a report that establishes a plan to systematically evaluate the hazards of known technical issues[13], including those involving the WAC. This report will be updated periodically.
- Deliverable 5.7.3.2 is a revision of the Interface Management Plan (which governs the process for developing and implementing interface controls between TOC and WTP). In particular the process for allocating risk between WTP and TOC is addressed in considerably more detail. This is discussed further in the section below on interface management.
- Deliverable 5.7.3.4 is a report on key inputs, assumptions, uncertainties, and safety margins to be included in the WTP WAC [12]. A number of gaps and uncertainties about the WAC are identified in this document.

Future deliverables include a final gap analysis, after the TOC and WTP testing programs are completed, and the optimized DQO.

Both TOC and WTP have significant test programs ongoing to provide data that supports the information needs of the IP. TOC is conducting small scale mixing demonstration (SSMD) testing and testing of the Isolok® sampling device. WTP plans to conduct Large Scale Integrated Testing (LSIT), which also includes testing of the Isolok® sampling device. Accordingly, there is cross-review of each other's programs and 2010-2 deliverables in areas of mutual interest such as sampling and simulant development. The TOC mixing test stand is shown in Figure 3.

Figure 3 - Tank Farm Mixing Test Vessel

Single Shell Vessel Riser Cut

TOC has developed a single-shell tank retrieval technology called the mobile arm retrieval system (MARS) that has proven very useful is retrieving waste that is not amenable to the sluicing/pumping approach. In order to install this equipment in a tank, a new riser in the center of the tank dome needs to be cut. A cut of this type had been made in 2010 using a water jet with garnet as the cutting agent. Another cut is planned, and since garnet exceeds the hardness assumed in WTP erosion calculations, DOE requested the One System organization to evaluate and recommend an alternative.

The evaluation culminated in a jointly issued report that looked at alternatives to water jet cutting, alternatives to the cutting abrasive if water jet cutting is retained, and potential impacts on from the cutting process WTP [16]. The report concluded that water jet cutting was still preferable to other alternatives, largely because it resulted in appreciably lower radiation doses to the workers. The report also recommended that olivine be substituted for garnet as the cutting agent. Olivine is a commercially available cutting agent with a hardness that is within the WTP analytical basis. The report contains a detailed analysis of the potential impacts on vessel erosion and equipment wear and concludes that the incremental impact of about 7500 pounds of olivine is insignificant compared to other erodent's in the waste feed. The report was jointly authored, checked and approved by One System TOC and WTP members and approved by the One System TOC Manager and WTP Deputy Manager.

Figure 4 shows cutting in progress during the 2010 dome cut. The arrangement includes a primary and two spare hoses that convey the cutting slurry mixture of water and, in this case, garnet at 48,000 psi. The cut was through about 15" of concrete and rebar and created a 55" diameter riser. The cut took less than 24 hours to complete.

Fig. 4 - Single-Shell Tank Dome Cutting in Progress

Disposition of WTP Secondary Waste

TOC is responsible for collecting and arranging for disposition of WTP secondary wastes and WTP is responsible for estimating the amount of such waste that will be generated. The Secondary Waste and Product Qualification Group in the One System Technical Organization manage these issues.

A disposal gap analysis [17] was conducted to confirm that there was a destination for the various secondary solid waste streams. The conclusion is that the vast majority of the radioactive solid wastes had provisional disposal pathways; the exception being items contaminated with HLW feed or HLW glass. The report also concludes that some accumulation or temporary storage facility will be needed, preferably near the WTP.

The absence of such a facility prompted an evaluation of a jointly used facility to support WTP operations and increased volumes projected to come from tank farms. This facility could use an existing WTP construction that is on the border of the WTP site, adjacent to TOC 200 East Area tank farms and facilities. This concept is undergoing review, including with DOE.

Interface Management

WTP relies on a number of technical services from other Hanford contractors for WTP's construction and commissioning. These same services will be required of the future WTP operations contractor. Coordination and planning for WTP's outside interfaces and services are critical for the plant's successful design and operation in processing the tank waste at the design rate. BNI has an active interface management program that has recently been improved through organizational and issue management changes. The TOC contract includes provision for the management of the interfaces between WTP and other Hanford contractors (primarily the Mission Services Alliance (MSA)). There are 15 ICDs, 14 issued and one planned for the future. Periodic reviews and updates are required. The One System Technical Interface Integration group manages the ICDs. A full accounting of the progress of the ICDs is given in Reference 18 [18].As noted earlier in this paper, one of the jointly prepared DNFSB Recommendation 2010-2 deliverables was an updated Interface Management Plan [19]. The plan is improved by referring significant open issues/risks to the TOC and/or WTP risk management programs and by clearly identifying WTP and TOC Environmental and Nuclear Safety personnel as key participants in revising ICDs that have an environmental or nuclear safety aspect to them.

Flowsheet Alternatives

In early 2012, DOE tasked WTP with a re-baseline of the project. Included among the various deliverables for this endeavor was a proposed set of options to the current baseline, including direct feed from tank farms to the high level waste (HLW) facility, (direct feed to the low-activity waste (LAW) vitrification facility, as proposed in the 2020 Vision proposal [1], was also directed as part of the re-baseline, rather than as a proposed option).

WTP in conjunction with the TOC put together six flowsheet options involving direct feed to HLW, LAW and changes to WTP's Pretreatment facility. Four of six options presented were developed by TOC. These six options were reviewed and commented upon in a One System-sponsored workshop held on May 10 and 11, 2012. The workshop included personnel from WTP, WRPS, DOE, Pacific Northwest National Laboratory (PNNL), Savannah River National Laboratory (SRNL), and the Washington State Department of Ecology. Input was obtained from all participants. In June, 2012, TOC, WTP, and DOE met to discuss DOE priorities relative to the options. DOE expressed a preference for options that provide direct feed to LAW (already directed by DOE), mitigation of technical issues in WTP (e.g., feed pre-conditioning), lower cost in the near-term, and not precluding other options in the future. From this meeting, the development of a seventh option was undertaken that focused on pre-conditioning slurry feed to separate out large, dense, particles that would be a challenge to the WTP pulse jet mixing (PJM) design.

On September 7, 2012 WTP and TOC made a presentation to the Secretary of Energy's team that is examining the WTP technical issues, on the options note above, and were asked to present a combined option dealing with pre-conditioning feed to Pretreatment and direct feed to HLW. As announced in the Secretary's message of November 7, 2012 [20], a technical team evaluating feed pre-conditioning has been formed to further work on this option and includes representatives from TOC and WTP.

CONCLUSIONS

In the approximately one year that the One System Technical Organization has existed, it is evident that the original vision was valid: an integrated and co-located technical team involving the entity delivering feed and the entity providing the processing facility for that feed can improve the management of the technical interfaces with such an organizational arrangement. The examples of efficient and effective teaming on issues such as responding to the DNFSB 2010-2 recommendations and the associated testing programs, finalizing the WAC, and the pursuit of opportunities such as managing secondary solid radioactive waste in a common facility are evidence of this.

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