THE EVOLUTION OF PRIVATIZATION AT HANFORD'S TANK WASTE TREATMENT COMPLEX

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ABSTRACT

Privatization acquisition strategies embody substantial contract reform principles—private financing and ownership, competition, fixed prices, and payment only upon delivery of services—which in time became the recipe for privatization of Department of Energy (DOE) Environmental Management (EM) cleanup projects. Privatization changes the federal government's approach from traditional cost-plus contracting, where the federal government pays the contractor as the project progresses, to a strategy where the federal government pays for products or services as they are delivered. To be successful, the privatization requires additional risk taking by the contractor.

This paper focuses on why the Tank Waste Remediation System (TWRS) pursued privatization, how the TWRS Privatization Project matured, and why the privatization project moved to an alternate path. The paper is organized as follows: a description of the TWRS-Privatization framework, how the project changed from the original request for proposal through the decision not to proceed to Part B-2, and the lessons learned during evolution of the effort, including what worked as well as what went wrong and how such negative outcomes might be prevented in the future.

INTRODUCTION

Secretary of Energy Hazel O'Leary estimated that privatization could save the U.S. Department of Energy (DOE) money and improve the efficiency of its operations. Privatization is primarily an alternative contracting and financing strategy to foster open competition for fixed-price contracts; require the contractors to design, finance, build, own, and operate the facilities necessary to meet treatment requirements; and pay the contractors only for products or services delivered in accordance with the contracts. Privatization was intended to help DOE harness both technical and market forces to reduce the overall cost of accomplishing DOE program goals, and to transfer greater risk to private contractors in return for incentives that aligned contractor performance with DOE objectives.

One of the first projects developed under the DOE Contract Reform efforts was the Tank Waste Remediation System (TWRS) Project at the Hanford Site in Richland, Washington. This Project requires the design, construction and operation of a waste vitrification facility capable of rendering radioactive liquid and sludge wastes into a vitrified waste form suitable for long-term storage.

TWRS PRIVATIZATION PROJECT FRAMEWORK

The Hanford Site in the southeastern part of the state of Washington is the location of 53 million gallons of highly radioactive waste stored in 177 underground tanks with a capacity of a half-million to one million gallons. The waste is the legacy of nearly 50 years of chemical processing to produce plutonium for nuclear weapons, which began with the Manhattan Project in the 1940s and continued through most of the Cold War. In 1992, DOE established the TWRS Project to store, treat and immobilize the radioactive tank wastes. The Project was expected to cost $40 billion and to be completed over 45 years.

Because of the large amount of money involved, DOE sought measures to control cost growth and reduce schedule delays. Privatization had shown in numerous cases that competition and proper risk allocation saved the government around 30 percent over buying the services in-house. A systematic analysis of TWRS was carried out in 1994 and 1995 to examine the feasibility of procuring waste treatment and immobilization services from the private sector (Holbrook, 1996). A TWRS acquisition strategy was proposed that included a number of features of contract reform—private financing and ownership, competition, fixed prices, and payment only upon delivery of services—which in time became known as TWRS Privatization (TWRS-P).

Table 1 summarizes the evolution of TWRS-P. The Table is divided by the project phases. The project evolution summarized in the Table is described in subsequent sections and illustrated in Figure 1.

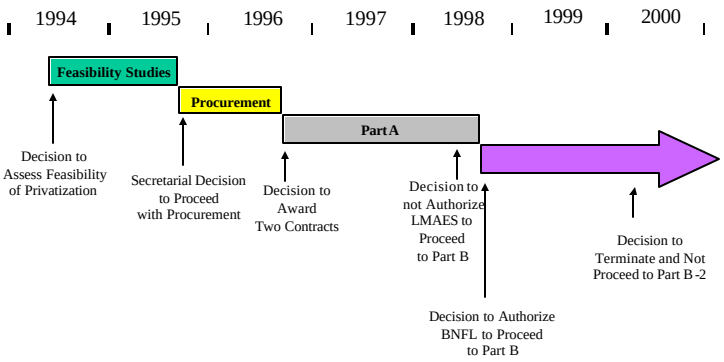

Fig. 1. TWRS Privatization Timeline

Table I: Summary of TWRS Privatization Project Evolution

Phase	Concept	Target Price	Risk Allocation	Deactivation Date
Original Concept	Two small plants with several bidders	$3 billion (two Low Activity Waste (LAW) and one High Level Waste (HLW) plant)	Most risks to contractor	FY2006
Part A	Two bidders with significantly larger plants	$3.2 billion (one LAW plant and one HLW)	Better understanding of costs of risk to DOE and lowest price resulted from sharing of risks	FY2006
Part B-1	One bidder with plant large enough to produce maximum order quantity	$6.9 billion (one larger LAW plant and one HLW with longer construction period)	DOE accepts inflation risks, many risks shared including environmental compliance	FY2018
Part B-2	Terminated	$15 billion	Risks shifted back to DOE through high contingency fees	FY2018

Request for Proposals (RFP) and Procurement

The TWRS-P Part A RFP was issued in 1996. The RFP specified that the government would furnish materials to the contractor, such as, waste feed, water, and electricity. The contractor would return to DOE remediated waste streams in specification-compliant form and other allowable radioactive and hazardous waste streams.

Part A of TWRS-P was to be a 16-month long development phase where up to three contractors would design small vitrification plants and submit fixed prices at the end of Part A for an opportunity to build pilot plants to process some of the Hanford tank waste in Part B. The contractors then would compete for an opportunity to build full-sized plants in a second phase. Two bids were received in August 1996 and awards were made to both contractors: BNFL, Inc. (BNFL) and Lockheed Martin Advanced Environmental Systems (LMAES). The bids were for facilities that were significantly larger in overall size due to greater radioactive shielding and seismic requirements than the government had originally estimated.

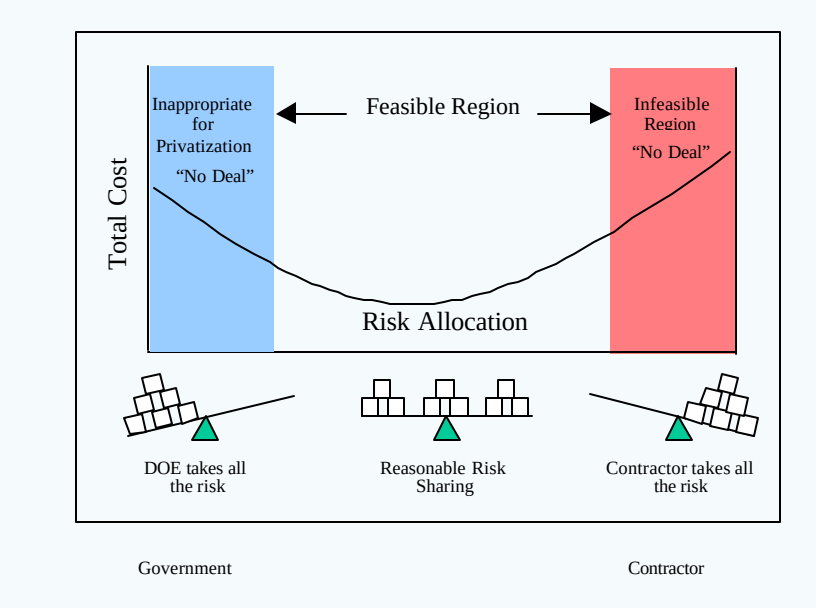

Fig. 2. Risk Allocation Concept

Part A Contract

During Part A, DOE found that the allocation of risks had a direct bearing on the total cost of the project. A complete assignment of risks to the private contractor would lead to very high total cost to DOE because of the risk premium that the contractor would charge for taking on risks that it was not equipped to control. A middle ground, as shown in Figure 2, was established where DOE shared risks with the contractor, which led to savings in total cost to DOE.

The Office of Safety Regulation of TWRS-P Contractor (also known at the Regulatory Unit) was established during Part A to provide safety regulation of Radiological, Nuclear and Process Safety (RNPS) and Industrial Health and Safety (IH&S) of the TWRS-P contractor. The Regulatory Unit (RU) was a separate office within the U.S. Department of Energy, Richland Operations Office (RL).

Part A deliverables were received in January 1998. At that time, LMAES was not authorized to proceed because their deliverables failed to convince DOE that the selected processes were technically viable. Unfortunately, TWRS-P lost the benefits of competition at the end of Part A.

Negotiation for Part B-1 of the Contract

After review of Part A deliverables from both contractors, DOE concluded that the private sector was not yet in a position to guarantee fixed prices without excessive contingencies added to the bid price. This issue caused the contract to be split into Parts B-1 and B-2, to provide DOE with an off-ramp. Part B-1 was a 24-month design phase to provide DOE with another decision point in order to determine whether to proceed to construction.

More than 30 different allocations of five major risks were analyzed prior as part of Part B-1 negotiations. Four risk allocation alternatives had particular significance to DOE and were identified for further discussion and analysis:

- **DOE Risk Boundary Case.** DOE has its maximum acceptable risk posture for each of the five major risks.
- **Contractor Risk Boundary Case.** The contractor has its maximum acceptable risk posture for each of the five major risks.
- **Shared Risk Case.** Each of the five major risks is shared to the extent practical.
- **Lowest Total Cost Case.** This represents the lowest expected DOE cost case, where DOE accepts the inflation, technical development and, due to government credit supports, a significant portion of the process performance risks. DOE and the contractor share the risks for the interest rate and environmental permitting.

Table 2 shows the risk allocation strategy associated with each case. The results (in millions of dollars) are shown in Table 3. There was significant risk sharing for the lowest total cost case.

Table II: Principal Risk Allocation by Case

	Inflation Risk	**Interest Rate Risk**	**Environmental Permitting Risk**	**Technical Development Risk**	**Process Performance Risk**
DOE Risk Boundary Case	DOE	DOE	DOE	DOE	Shared (more to DOE)
Contractor Risk Boundary Case	Contractor	Contractor	Contractor	Contractor	Shared (more to Contractor)
Shared Risk Case	Shared	Shared	Shared	Shared	Shared
Lowest Total Cost Case	DOE	Shared	Shared	Shared (more to DOE)	Shared (more to DOE)

Table III: Simulation Results ($1997 Millions)

	Total DOE Cost	**DOE Cost Variability**
DOE Risk Boundary Case	7,505	1,089
Contractor Risk Boundary Case	12,692	58
Shared Risk Case	10,429	467
Lowest Total Cost Case	7,433	887

The project's size precluded the contractor from fully guaranteeing the facility's performance, therefore, the government agreed to backstop a tranche of the debt under limited circumstances. This debt support would represent the lenders' last resort in the event the project encountered problems and would be triggered only after all committed equity, guarantees and warranties were fully exhausted.

Part B-1 Contract

BNFL was authorized to proceed to Part B-1 of the contract in August 1998. The detailed analysis that DOE carried out to arrive at the Part B decision is described in a Report to Congress (DOE, 1998).

During Part B-1, the contractor and DOE arrived at a pricing structure that provided the contractor with the ability to obtain financing, make a reasonable profit, and earn additional fee. The pricing mechanism allowed the contractor to take credit for products produced in prior periods that were above the base capacity. The cumulative quantities from past periods could be used to fill the current period's base capacity requirement if the facility was inoperable or not operating at expected efficiency.

Another concern throughout Part B-1 was the cost of private sector financing. Different contracting and financing alternatives were investigated to determine if there were less expensive alternative financing approaches. A cost difference was found to exist between the cost-plus contracting and fixed-price contracting approaches, with cost-plus approximately 38 percent higher after accounting for cost growth and the time value of money. Alternatives to 100 percent private financing would increase total project cost and require complex contractual structure to protect the private lender and government interests.

During Part B-1, DOE went to considerable effort to evaluate the "price reasonableness" of the contractor's Part B-2 proposal. DOE needed to be able to quickly ascertain that whether the contractor's proposal had a valid cost, schedule, technical and financial basis. DOE prepared a process logic for deciding whether to proceed to Part B-2. (See Figure 3) In addition, DOE prepared the Government Fair Cost Estimate (GFCE) using an independent contractor. The GFCE was not provided to BNFL. The GFCE provided DOE with the critical information necessary to analyze whether the contractor's proposed price was a good value for the government.

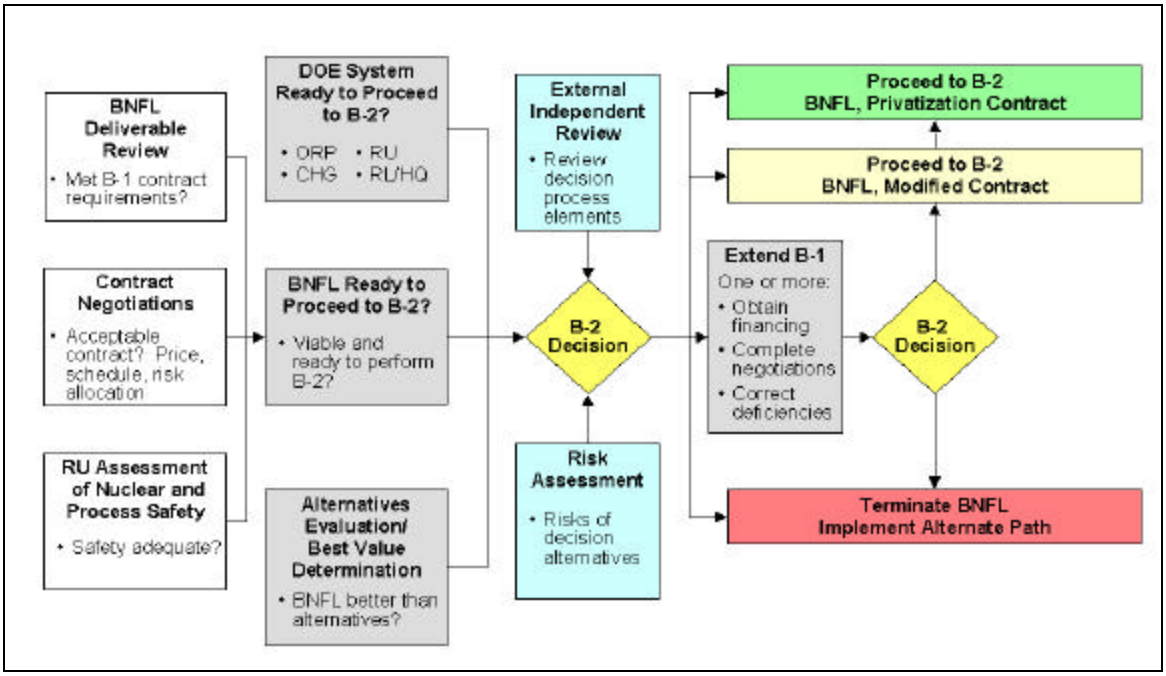

Fig. 3. Part B-2 Authorization to Proceed Decision Logic

Contract Termination

DOE completed a comprehensive review of the Part B-1 contract deliverables received on April 24, 2000, and on May 8, 2000, made the decision to discontinue the privatization approach for the RPP treatment and immobilization. The primary conclusions reached during the review were that the:

- Design and technology solution presented one possible solution that appeared to meet environmental compliance, mission performance, and waste disposal requirements, but has significant potential for optimization;
- Business approach was unacceptably conservative, with significant and unsubstantiated growth in proposed prices; and
- Management and corporate capability to deliver the project was challenged by open questions on safety, quality, and project management capacity.

THINGS THAT MIGHT HAVE BEEN DONE DIFFERENTLY

Privatization was a new concept. The goal was to use private sector financing to obtain the best value to the Federal government. A number of actions are identified that should be integrated into future attempts at contract reform.

Management And Contracting

DOE should negotiate the price, cost elements, and fee structure while still in the competitive environment.

There was a lack of specificity on the risk balance between the private contractor and the government. It was not clear to either the contractor or DOE the acceptable risk balance to the government.

During the time Part B-1 commenced and concluded, interest rates increased. For long-term projects, financing costs can dramatically affect project costs.

DOE must ensure that the contract guarantees complete ownership of contract information at contract termination. The contract needed to be written with language that clarifies property--facilities and information--transfer in a termination scenario.

Technical and Engineering

While the conceptual design and supporting information is sound and robust, there is significant potential for optimization. For instance:

- Sizing of equipment and vessels needs to be reexamined to ensure best value to government (they were oversized in some instances). DOE should actively manage design to ensure decisions are in the best interest of the Government. Design reviews with active DOE participation are critical.

- There were difficulties with waste certification and qualification strategies. BNFL planned to qualify glass on a tank-by-tank basis, which had a negative impact on waste loading and increased overall glass waste volume.

ES&H

The permitting schedule was significantly ahead of the design and engineering schedules, because final permits were required by financial closure. This resulted in development of permitting materials with an insufficient design basis. Permitting schedules need to be better factored into future projects.

Some elements of environmental permitting required coordination with the RU. Although all external regulators cooperated to the extent possible, this coordination was difficult due to the project maturity and associated state of development within each regulator's purview.

Interfaces

Interfaces were managed through the use of Integrated Product and Process Teams (IPTs). The Project Management IPT was not used as a decision-making forum or a forum to develop direction to the lower level IPTs, which limited the effectiveness of the entire process. In addition, IPTs did not prepare change packages nor move them forward for approval, as required by the Integrated Product and Process Development (IPPD) process. The IPT process, while a viable concept, needs to be streamlined to ensure its success.

Project Finance And Cost/Schedule

Managers experienced with fixed-price contracting approaches on both sides were needed to agree on what stage of design (e.g., 30 percent, 60 percent, or another level) was necessary to fix prices. Experience with commercial fixed-price contracts indicates that prices can be fixed at 30-percent design without excessive contingency because all of the takeoffs would be developed at that point. Staff with cost-plus contract experience believe they need 60-percent design in order to fix-price a contract.

It is crucial to understand the ramifications of using debt financing (as well as requiring a significant equity commitment on the part of the contractor) on the final fixed price. Critics of the TWRS-P approach were quick to point out that the portion of the price connected with private financing cost appeared high, even before the rapid cost growth at the end of the privatization effort.

Regulation of Radiological, Nuclear, and Process Safety

Closer coupling of the regulatory activities with the TWRS-P activities being managed by DOE, while maintaining the independence of the regulatory organization, would have been beneficial. On occasion, DOE encouraged the contractor to implement changes in the design before the potential safety impact (and thus cost impact) was considered.

THINGS THAT WORKED WELL

This Section provides specific benefits resulting during the period.

Management And Contracting

The privatization contract included a number of clauses that enhanced contractor performance. For example, the use of long-term incentive goals (no payment until a good product is made) created a potential win-win opportunity for DOE and the private contractor.

The creation of the separate U.S. Department of Energy Field Office (e.g., the Office of River Protection or ORP) that was completely dedicated/focused on the contract and able to negotiate freely made DOE's job easier.

There was a good decision-making infrastructure developed in ORP for the B-2 Decision Process. It was a well thought out, disciplined approach where all the pieces were well defined and integrated.

Technical and Engineering

DOE spent extra planning effort to ensure that the TWRS-P contract described technical requirements well. This helped DOE in the ability to choose a technically competent Contractor to carry out design.

DOE originally envisaged low cost 'throw-away' facilities, but contractors determined that this concept would not meet nuclear safety criteria and based their bids on traditional nuclear processing facility requirements. After review, DOE concurred with the contractors' analysis and accepted the proposed facility designs prior to entering into Part A.

The deliverable review process for BNFL design phase deliverables worked well. Each deliverable had an Evaluation Plan, which was shared with BNFL and clearly spelled out requirements and expectations. DOE conducted the review of the deliverables using a systematic process. Reviewers were trained in the review process. Offsite reviewers utilized the same methodology, receiving deliverables by CD-ROM and returning their comments by e-mail. Comment letters were transmitted to BNFL.

The BNFL conceptual design submitted on April 24, 2000, was determined by ORP and several external independent reviews to be technically sound, robust and meet safety and environmental compliance requirements; albeit still providing significant potential for optimization. The design and process flowsheet was underpinned with Research and Technology (R&T) experiments using actual tank wastes from several tanks. These R&T results demonstrate that the process flowsheet can easily meet all DOE requirements for waste treatment and immobilization as shown below:

- Pretreatment requirements for radionuclide removal were exceeded:
  - Cesium by a factor of ~20
  - Technetium by a factor of ~2
  - Strontium by a factor of ~4
  - Transuranic species by a factor of ~7

- Low Activity Waste (LAW) immobilization requirements were exceeded by:
  - Immobilized LAW throughput by a factor of ~1.5
  - Glass durability easily meets long-term performance needs
  - Waste loadings were acceptable

- High Level Waste (HLW) immobilization requirements were exceeded by:
  - Immobilized HLW throughput by a factor of ~1.3
  - Glass durability requirements were easily achieved
  - Glass waste loadings exceeded contract requirements

ES&H

Good progress was made on *Resource Conservation and Recovery Act of 1976* (RCRA) and *Clean Air Act* (CAA) permitting during Part B-1, consistent with available design and engineering data. Establishment of permitting and compliance interfaces got off to a good start, although many details remain to be worked out. Concurrence on permitting materials was expedited through teaming with DOE, the contractor, and regulators. The contractor's relationship with the regulators was excellent; they were cooperative and helpful despite the need for information that is yet to be developed.

Interfaces

The Waste Treatment and Immobilization Plant (WTP) would require services from other organizations through defined interfaces. The approach to interface management was successful. High-level interface definitions (interface descriptions) included in contracts provided interface stability and a good basis for control of changes. A formally defined process for interface management provided team members with a predictable process. Small multi-disciplinary working groups known as IPTs provided an effective method for developing good solutions quickly and ensuring that all aspects of the interface are developed and maintained. Documentation in the form of timely meeting minutes, action items lists, detailed meeting agendas, and Interface Control Documents (ICDs) were critical to the success of interface management.

Project Finance and Cost/Schedule

The financial markets enthusiastically embraced the Privatization concept. This indicates that the finance community was satisfied with available estimates of cost and schedule. More than enough capital was brought forth during preliminary meetings with the investment banks, indicating that the size and complexity of the project was not beyond the appetite of the market.

The GFCE proved to be extremely important in evaluation of the contractor proposal. Particularly, in an instance, such as TWRS without direct head-on competition, the GFCE is essential to achieving a fair fixed price.

Regulation of Radiological, Nuclear, and Process Safety

During Part A, the RU learned the importance of having direct involvement with the contractor to understand the design and the potential safety program implementations. As a result, in Part B, the RU directly participated in the design review process to become more knowledgeable of the design and its safety impacts. In addition, an intensive and intrusive inspection program was initiated to ensure that the contractor was implementing integrated safety management, and monthly topical meetings were established to identify and resolve potential safety issues that could later impact cost and schedule. These Part B changes were successful in moving the program forward.

Two documents, the Regulatory Policy and the Memorandum of Agreement, which were based on lessons learned from previous internal and external regulation, were critical to the success of the regulatory program. The two documents established DOE objectives for regulation of the contractor, sanctioned it to be performed locally, and clearly defined interfaces and responsibilities for both DOE Headquarters and the field organizations.

A regulatory plan and four documents that defined the regulatory concept, process, and the top-level standards and principles were also instrumental in the success of the regulatory program. The documents, along with the contract itself, clearly defined how the regulatory process would be implemented and defined the expectations of the contractor and of DOE. The documents placed clear responsibility on the contractor to implement an integrated safety management program that resulted in adequate protection of the workers, the public, and the environment, with DOE assigned responsibility for ensuring that the integrated safety management process was followed.

Use of a regulatory process fully open to the public, i.e., all interactions between DOE and the contractor on regulatory decisions were open to the public, was found to improve the process by building confidence and support with the stakeholders while aiding early resolution of potential safety issues.

HOW THE KEY LESSONS WERE INCORPORATED IN THE PATH FORWARD

On May 8, 2000, DOE terminated the privatization contract and pursued two concurrent paths. First, DOE acted quickly to implement an interim contract to avoid unnecessary delay in the program and maintain existing project momentum. In order to provide a level playing field for the new WTP contract procurement, the responsibility for control of the conceptual design and supporting information was transferred to CH2M HILL Hanford Group, Inc. (the tank farm contractor). During the interim design period, CH2M HILL Hanford Group, Inc. was tasked with several responsibilities:

- Prepare for efficient transition to the WTP contractor;
- Document and control the technical baseline;
- Organize and update the design products;
- Perform optimization studies;
- Continue the planned R&T activities to underpin the flowsheet and permitting;
- Advance the environmental permit applications; and
- Close out open safety issues.

Second, DOE issued a new RFP for design, construction, and commissioning the WTP in August 2000, with contract award made in December 2000. The conceptual design and supporting information formed the basis for the WTP contract.

Other similarities or features imported from the TWRS-P approach include:

- Detailed scope of work with technical requirements clearly specified.
- Prime contract to DOE, not a subcontract to the management and integration (M&I) contractor.
- Contract written so contractor is rewarded for superior cost and schedule performance.
- Performance-based contract:
  - Contractor owns performance risk;
  - Nearly all fee tied to performance of facility and meeting schedule; and
  - Contractor's job not done until plant works.
- Standards-based approach—tailored set of environmental, safety, and health requirements.

Key differences from the TWRS-P approach are:

- Cost-plus-fee approach;
- Target cost, schedule and fee determination methods established prior to contract award;
- Not privately financed;
- Scope is through completion of plant commissioning; and
- Plant operations will be a separate contract.

ORP subsequently analyzed the path forward for the River Protection Project, and included a description in a recent Report to Congress (DOE-ORP, 2000)

CONCLUSIONS

Privatization of the Hanford treatment plant was a dramatic attempt to fundamentally change the contracting approach employed by DOE. Privatization as a concept remains viable given certain conditions and mechanisms to ensure the Government's interests are protected. Unfortunately, several key enabling factors changed affecting the viability of their privatization. First, the facilities were much larger, more complex and more costly than originally estimated. This led to larger contractor risks and financing costs than planned. Secondly, the prospect of competition was lost when LMAES was determined to be technically non-viable at the end of Part A. Without competitive pressures during Part B-1, BNFL shifted technical risks back to DOE in the form of conservative estimates, plans, contingencies and pricing methodologies.

Fortunately, DOE built several off-ramps for exiting the privatization concept, one at the end of Part A, and one at the end of Part B-1, which DOE exercised. The rigor by which DOE specified what it wanted in terms of deliverables and facility requirements provided a robust and technically defensible conceptual design and supporting information from which to proceed.

The current WTP contract builds upon the lessons learned from Privatization. First, the award was conducted with competitive pressures, with the offerors bidding against a predetermined DOE baseline. Secondly, the contract includes fee incentives for lowering cost, accelerating schedule and overall facility performance, without placing the contactor in a position that would require excessive contingency. Finally, the contract provides DOE more control and information access to better manage and track overall contract performance.

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