COST/SCHEDULE OPTIMIZATION IN THE DEFENSE TRU WASTE PROGRAM

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ABSTRACT

In October, 1988, the Waste Isolation Pilot Plant (WIPP) will begin receiving defense transuranic (TRU) waste for deep geologic disposal. Six storage sites and various generator sites will be shipping waste to the WIPP.

In 1985, a Cost/Schedule Optimization Study of the defense TRU waste management program revealed that DOE could reduce future program costs by over $100 million, without compromising program goals. Two of three major recommendations were immediately implemented; the third is being examined for its technical feasibility.

INTRODUCTION

The defense TRU waste management program and its associated long-range planning activities are described in References 1-2. Since 1970, defense TRU waste has been retrievably stored at six Department of Energy (DOE) sites, pending selection and development of permanent disposal methods. There are at present approximately 80,000 cubic meters of retrievably stored contact-handled TRU waste at DOE sites, and new contact-handled waste is being generated at the rate of about 5500 cubic meters per year. Additionally, there are approximately 800 cubic meters of remote-handled TRU waste in storage, with a projected generation rate of about 50 cubic meters per year.

In June, 1983, President Reagan submitted to Congress The Defense Waste Management Plan[1], describing reference plans for the permanent disposal of high-level and transuranic wastes from defense programs. The Long Range Master Plan[2] expands on these reference plans for the TRU waste program, by providing a framework for detailed planning at each of the storage and generating sites. Schedules have been identified for design, construction, storage, retrieval, processing, and shipping activities over the period from 1984 to 2015, with particular emphasis on activities in the 1980s and early 1990s.

THE NEED FOR OPTIMIZATION

Optimization of the defense TRU waste program is a necessary function to ensure that program goals and plans are optimized from a cost and schedule aspect. Results of the study offer DOE information with which it can establish the most efficient program for the long-term management and disposal of contact-handled (CH) TRU waste. Toward this end, institutional concerns, per se, were not allowed to foreclose promising options at the analysis stage. However, institutional issues were identified, where appropriate, as potential impediments to implementation of some alternatives.

The diversity and complexity of the defense TRU waste management program leads to many opportunities for system-wide cost savings. Because optimizing costs at one site may impact other sites to yield a net loss to the total system, it was very important that a system-wide approach be used in the Cost/Schedule Optimization analysis.

METHODOLOGY AND ASSUMPTIONS

The Cost/Schedule Optimization Study examined system-wide cost and schedule impacts of all reasonable alternatives for managing, certifying, processing, shipping, and disposing of defense TRU waste, in order to reduce costs to the minimum possible level, consistent with achieving major program goals. The study was limited to CH waste; a study of remote-handled waste is presently in progress. In performing the work great care was taken to involve each major waste generator and storage site and the WIPP. This involvement led to greater field site appreciation of the importance of a system-wide perspective for decision making and allowed smooth implementation of recommendations, since all affected organizations understood the goals and methods and had input to all phases of the work.

It was decided that institutional factors would not automatically disqualify certain scenarios. DOE wanted to examine all technically feasible alternatives, without regard to political ramifications. In this way, it was possible to put a "price tag" on political/institutional decisions. Predictably, this was the most controversial aspect of the study methodology but also yielded the greatest benefit since it challenged several deeply rooted program assumptions. Figure 1. shows a traditional approach to selection of acceptable alternatives: seeking alternatives which are technically, economically, and institutionally sound. Figure 2 shows the approach used for this study, which opened a wider array of possibilities.

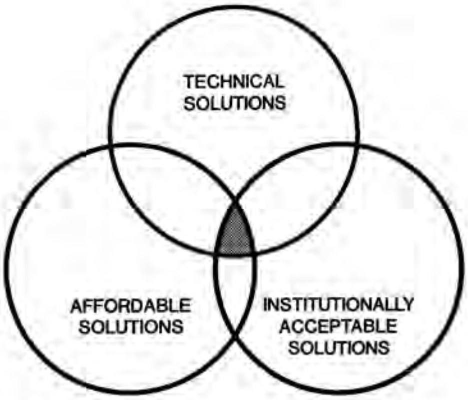

Fig. 1. Traditional Approach to Selection of Acceptable Alternatives.

Fig. 2. Approach Used in Cost/Schedule Optimization.

Computer models were used in the study to test the cost and schedule impacts of alternatives. These models, described at WM '85 [3], were:

1. M-PLAN, a waste inventory work-off model
2. TRUSIM, a transportation simulation model
3. TRUCOST, a cost model of the Defense TRU Waste Management Program
4. LisaProject, a program management/scheduling model.

SELECTED SCENARIOS TO BE ANALYZED

After all DOE offices and contractors involved were briefed as to the importance of the task, and the best data available was collected, a list of representative scenarios to be analyzed was selected from a large list of possibilities. In the study, each scenario was compared to the base case. The base case consists of current program plans, as follows:

1. Waste processing at Idaho National Engineering Laboratory (INEL), Hanford, Savannah River Plant (SRP), Los Alamos National Laboratory (LANL) and Rocky Flats, as required to meet WIPP acceptance criteria,

2. Transport of CH-TRU waste to WIPP in the Transuranic Package Transporter (TRUPACT),

3. Shipment of drums in units of six ("six-packs"),

4. 25-Year stored waste workoff,

5. WIPP operation 10/88, with all sites shipping to WIPP beginning 10/88, and

6. No waste processing at WIPP.

The list of scenarios selected for final analysis was as follows:

1. Ship all difficult-to-certify waste from all sites to INEL for processing, as an alternative to site-by-site processing. Difficult-to-certify waste is defined as that waste which cannot be certified with inexpensive techniques such as quality assurance (QA), non-destructive examination (NDE), and non-destructive assay (NDA).

2. Ship ORNL difficult-to-certify waste (if any) to SRP for processing, rather than processing at ORNL; also analyzed was the possibility of shipping LANL Pu238 waste to SRP, which is scheduled to have Pu238 waste processing facilities.

3. Ship difficult-to-certify waste to the WIPP site, where a processing facility would be built to handle this waste.

4. Determine the relative economies of shipping TRUPACT by truck versus rail.

5. Analyze the cost impact of shipping individual drums versus six-packs to WIPP.

6. Analyze the cost impact of alternate sized TRUPACTs for transporting waste to WIPP.

7. Analyze the cost impact of various stored waste work-off periods (12, 18, 25 years) for the retrievably stored waste.

8. Analyze alternate processing scenarios. It was determined when processing facilities must be on line to keep WIPP operating at optimum capacity so that it can fulfill its mission. Such things as sunk costs, limitations on drum life, and gas generation were taken into account.

9. Examine coding and labeling systems for the waste being shipped to the WIPP, to determine if there is any reduncancy in this aspect of the program.

No attempt was made to mix scenarios, since this would have created an excessively large number of possible combinations. Each scenario was compared only against the base case, even though combinations of scenarios may ultimately prove advantageous.

SUMMARY OF SCENARIO FINDINGS

Below is a scenario-by-scenario summary of the results from the study.

1. (Central Processing at INEL):

Centralized processing at INEL holds promise for reducing system cost, with potential savings as much as $88 million, based on mid-1985 cost estimates. This option is particularly attractive for sites with small volumes of waste requiring new, expensive processing facilities. In addition to these small volume sites, there are several larger waste streams in the system which should be considered for central processing, based on the cost of building site-specific facilities to treat specific streams.

A. Rocky Flats HEPA filters and sludges,
B. Hanford waste which must be shredded and grouted,
C. SRP Pu238 waste, and
D. LANL Pu238 waste.

There are, however, several technical and institutional uncertainties which could preclude parts of this option. The main technical uncertainty is whether the INEL processing facility (PREPP) can process large volumes of SRP Pu238 waste. An engineering feasibility study is underway to determine this feasibility. Also, some additional sampling of Hanford waste is required to determine its suitability for PREPP processing, and there is some concern regarding processing strategy at Hanford for oversize/overweight boxes, if on-site shredding/grouting is eliminated. Continued high priority on PREPP is necessary to ensure that, if PREPP is used for central processing, it is reliable.

2. (SRP Process ORNL Difficult-to-Certify and LANL Pu238 Waste):

ORNL has not yet identified any significant quantity of waste which requires off-site processing, so this option may be inconsequential. If LANL Pu238 waste cannot be certified for WIPP using existing or committed LANL processing facilities, it may be cost-effective to ship this waste to SRP for processing. This scenario involves a very small amount of waste.

3. (Central Processing at WIPP):

Processing facilities which are already committed (especially at INEL) have sufficient capacity to serve as central processing facilities. The additional capital needs for a processing facility at WIPP will more than offset any savings from transportation. Therefore, central processing at WIPP is not justified.

4. (Rail vs. Truck TRUPACT Shipment):

Truck shipment of TRUPACT is less expensive than rail shipment of TRUPACT unless large discounts from rail tariff rates can be negotiated. Rail shipment (75% rail/25% truck) substantially increases the required TRUPACT fleet size compared to all-truck shipment.

5. (Six-Packs vs. Individual Drums):

It is more cost-effective to ship drums to WIPP in six-packs than as individual drums, due to handling considerations at WIPP.

6. (TRUPACT Sizing):

This analysis was done in support of the Value Analysis Task Force (VATF) effort during the Spring of 1985 to look at design of the TRUPACT. The Value Analysis TRUPACT was slightly wider, could accomodate heavier payloads, and could be loaded and unloaded much more quickly and efficiently. This resulted in fewer TRUPACTs being needed for the fleet and fewer dollars being spent for operations. The VATF determined that up to $60 million could be saved by redesigning the TRUPACT.

7. (Stored Waste Work-Off Period):

Shorter stored waste work-off periods result in cost increases at WIPP and cost savings at major processing sites. Additional transportation costs are incurred from shorter stored waste work-off periods, due to the need for a larger TRUPACT fleet. Analysis indicates that there is a net cost increase from work-off periods shorter than the base 25 year period. Additional costs are on the order of $22 million for an 18 year work-off, and $42 million for a 12 year work-off.

8. (Alternative Processing Scenarios):

This scenario focuses on delaying construction and operation of Hanford and SRP processing facilities and delaying operation of PREPP and concludes that these delays are possible, since the INEL waste assay and certification facility (SWEPP) and generator sites can provide sufficient waste to keep up with WIPP demand until about 2004. To delay PREPP (and thereby raise its eventual annual throughput) would probably result in lower system cost due to the economies of three shift operations. However, for institutional and technical reasons, it is desirable to gain as much PREPP operating experience as soon as possible, particularly if PREPP is to be a central processing facility (Scenario 1.). Delay of other facilities would not result in any savings.

9. (Coding and Labeling Systems):

Several sites expressed the opinion that some effort should be made to consolidate coding, labeling, and color-coding requirements, and that these requirements should be rigorously justified on the basis of real need. An Interface Working Group, comprised of WIPP, the Joint Integration Office (JIO), and site personnel, has been established to look at bar coding. A bar coding standard is now being put in place. Color coding requirements for packages were eliminated.

A summary of the potential savings is presented in Fig. 3.

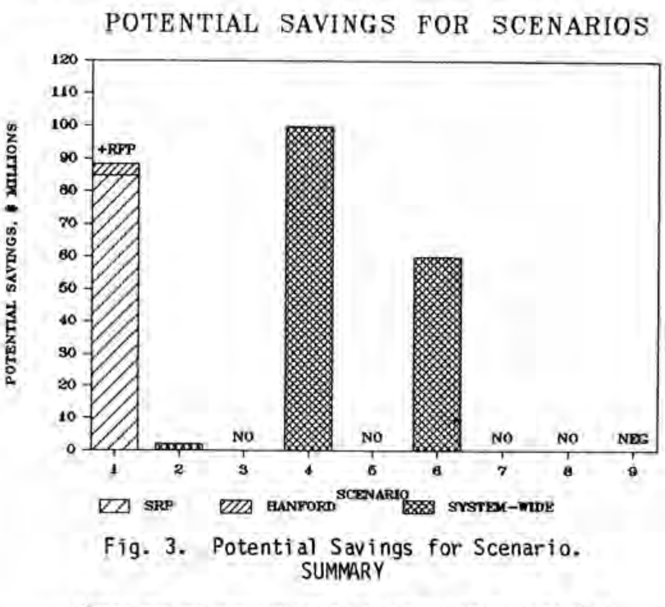

Fig. 3. Potential Savings for Scenario.

SUMMARY

Three major opportunities were identified for system cost savings: central processing at INEL, preferential (but not exclusive) shipment of TRUPACT by truck, and redesign of TRUPACT to increase the payload and improve packing efficiency. The first of these recommendations is undergoing engineering feasibility study; the second recommendation was used as an important input to determination of first increment TRUPACT fleet size; the third recommendation is being implemented as part of a broader TRUPACT design improvement program. We estimate that the implementation of Cost/Schedule Optimization Study recommendations has potential to save the program anywhere from $160 million to $250 million.

An important aspect of this work was the methodology whereby active participation of affected field sites was sought and obtained early in the program and then continued throughout the program. This was the most difficult aspect of the study, since it required multiple site visits and frequent revisions of earlier work in response to site comments. Through this process, we better understand site concerns and requirements, and sites better understood the study objectives and methodology, thereby reaching consenses on final recommendations.

FUTURE DIRECTION

The techniques used in this cost/schedule optimization effort have wide applicability outside the defense TRU waste arena and could be applied to the commercial high-level waste program. The methodology is similar regardless of the program.

1. Establish ground rules and objectives,
2. Develop computer models to process large numbers of alternatives,
3. Involve all affected parties so everyone understands constraints,
4. Distill large numbers of alternatives to a manageable size,
5. Make recommendations precise, succinct, and implementable, and
6. Move immediately to implement recommendations or remove obstacles to implementation.

The cost/schedule optimization effort for defense contact-handled TRU was exceptionally successful, and JIO is now applying similar techniques to the remote-handled fraction. We hope to be back next year to report equal success with the remote-handled program.

REFERENCES

1. "The Defense Waste Management Plan," DOE/DP-0015, June, 1983.

2. "Long Range Master Plan for Defense Transuranic Waste Management," DOE-TRU-8201 (Rev. 1), November, 1984.

3. "System Models Used in Support of Defense Transuranic Waste Management," J.A. Detamore, et al., Waste Management '85, Tucson.