COUPLING ENVIRONMENTAL CONTRACTING USING RISK ALLOCATION WITH U.S. DEPARTMENT OF ENERGY REMEDIATION MARKETPLACE

By:

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ABSTRACT

As the U.S. Department of Energy (DOE) Office of Environmental Management (EM) enters the 21st century, its primary mission remains unchanged: to clean up sites contaminated with radioactive, chemical, and other hazardous wastes from over fifty years of government nuclear operations, particularly weapons production. A major challenge confronting DOE EM in doing environmental cleanup is to improve project management and to allocate project risks into an optimal contracting strategy. Data show DOE's site remediation work as 30% of the U.S. remediation market with major remediation activities scheduled to occur by 2006. In the era of reduced funding and increased fiscal accountability, it is incumbent on DOE to adopt a cleanup strategy that applies best practices and expertise of private industry and capitalizes on optimal risk allocation among cleanup project participants. DOE should provide better incentives to accomplish its mission. Traditionally, DOE has focused on technical risk only. Lessons learned, however, from DOE privatization initiatives, such as Tank Waste Remediation System, show risks, including technical, operational/business, and people, are interrelated. To devise an effective cleanup strategy using improved project management and tailored contracting strategies therefore requires all risk to be addressed as an integrated composite. This paper presents an overview of outcome-oriented risk management and applicability of outcome-oriented risk management to accelerating DOE's cleanup mission. In the context of privatization and contract reform, the paper discusses how DOE could use risk allocation in environmental remediation contracts to achieve an optimal contracting strategy that is more efficient and effective for cleanup of contaminated sites across the complex. Technical risk includes new technology, its implementation and performance; operational/business risk includes site conditions, construction issues, program management, and financial risk; people risk consists of legal and procurement issues including liability and indemnification, regulatory and stakeholder acceptance of the technology, and associated political dimensions of the work. Use of outcome-oriented risk planning could enable DOE EM to identify, evaluate, and force tradeoffs, such as choosing goals, choosing alternatives to meet goals, and allocating budgets across sites and time periods. Technical risk translates directly to financial risk which, in turn, increases terminal risk and the cost of cleanup. Throughout risk allocation, optimal contracting strategy would need to preserve key benefits associated with third-party financing, including inherent performance incentives and requirements of private lending sources. Options for government involvement range between extremes of totally private or totally government financing, which should be assessed and applied project by project. The challenge for DOE is to be a smart customer and manage its contracts to optimize results.

INTRODUCTION

Within DOE, EM has as a primary mission the reduction of "threats to health and safety posed by contamination and waste (. . . 'legacy' activities . . .) at DOE sites including those associated with the nuclear weapons complex" (1). Legacy wastes, located at sites throughout the United States, were generated mainly during the latter half of the 20th century, beginning with the development of the atomic bomb in the 1940s and continuing into the Cold War Era of the 1950s through the 1980s. To accomplish its stated mission, DOE EM requires tremendous amounts of money; its budget request for Fiscal Year 2000 was $5.928 billion (2).

According to the Joint Institute for Energy and Environment (JIEE), "any operation that spends such large amounts of money produces benefits to many different parties and therefore could be considered to produce multiple outputs" (3). JIEE states, as regards DOE EM, "[O]ne product clearly dominates other outputs as the *raison d'etre* of cleanup: the management and reduction of risks that arise from wastes produced as by-products of weapons development and production during the Cold War. If one must choose a single cleanup product as a planning focal point, risk management and reduction is most important" (3).

With the signing of Executive Order No. 12866, *Regulatory Planning and Review,* in September 1993, the federal government began a program to reform the federal regulatory process and to make it more efficient. Twelve "Principles of Regulation" are listed in Section 1.b to ensure each agency's regulatory programs are consistent with

the philosophy described in the Order.[a] Among these principles, Section 1.b.4 states that "[i]n setting regulatory priorities, each agency shall consider, to the extent reasonable, the degree and nature of risks posed by various substances or activities within its jurisdiction" (4). Executive Order No. 12866 also requires each agency to prepare a Regulatory Plan each year that addresses the most important regulatory actions, proposed or final, that the agency plans to issue "that fiscal year or thereafter." At a minimum, the Plan must include six items enumerated in Section 4.c.1, including "[a] statement of the need for each such action and, if applicable, how the action will reduce risks to public health, safety, or the environment, as well as how the magnitude of the risk addressed by the action relates to other risks within the jurisdiction of the agency" (4).

In carrying out its mission to protect human health and the environment by cleaning up legacy wastes at contaminated sites throughout the United States, DOE EM stated six goals in 1994:

- eliminate and manage urgent risks in DOE's system;
- emphasize health and safety for DOE workers and the public;
- establish a system that is managerially and financially in control;
- demonstrate tangible results;
- focus technology development efforts on identifying and overcoming obstacles to progress; and
- develop a stronger partnership between DOE and its stakeholders (5).

In June 1998, DOE released *Accelerating Cleanup: Paths to Closure* (hereafter referred to as 2006 Plan), a blueprint for EM's cleanup program containing site-developed detailed scope, schedules, and costs to complete the work. A stated goal of this document, which is used as a management tool reflecting each site's best judgment as to what can be accomplished (assuming constant funding), is for DOE to clean up more than 90 % of its sites by 2006 (6). Beginning in October 1998, JIEE, supported by DOE EM's Office of Science and Risk Policy, issued a series of reports[b] designed "to probe alternatives to the current EM status quo and to stimulate debate and thought" (7). A primary objective of the series was to seek "to stimulate a dialogue over how best to implement a least-cost, risk-based cleanup that is realistic about the limitations imposed by technical uncertainties and by regulatory requirements" (7). An underlying theme is that DOE's 2006 Plan creates "a new class of risks—terminal risks," which effectively changes the way DOE EM must address risks. Terminal risks are defined as long-term risks that remain after 2006. Two other focal areas for risk management activities identified by JIEE include interim risks (those risks associated with hazardous lands or materials until treated) and clean-up safety (risks from the clean-up itself) (8).

DEFINING CONTEXT FOR OPERATION

In an effort to accelerate cleanup of legacy wastes and therefore to effectively and efficiently carry out its mission, DOE EM has undertaken several initiatives. Two of these are recognized by JIEE as of particular significance: implementation of the 2006 Plan and privatization (9). Privatization, as approached by DOE, involves redefining the relationship between DOE and its management and operating contractors. Particularly, the goal is to achieve less costly cleanup by increasing contractors' accountability, responsibilities, and profit opportunities while, simultaneously, reducing DOE's direct involvement in management and decision-making (9).

As recognized by JIEE, DOE EM's privatization strategy involves two essential features: use of fixed-price contracts and competitive bidding. By using fixed-price contracts, EM is striving to transfer part of the financial risk of project failure to its contractors; by placing contractors in competition with one another, EM is striving to ensure that its fixed-price contracts are low-priced (10). In carrying out its privatization strategy through the use of fixed-price contracts and competitive bidding, DOE EM is providing the proverbial joint "carrot and stick," enticement of profits and threat of losses, to the contractor. With fixed-price contracts, contractors are motivated to work independently and efficiently within an agreed-upon budget (10).

DOE's privatization contracting strategy, which began to emerge in the mid-1990s, seeks efficient and cost-effective cleanup of the environment by using proven technologies (both demonstrated and deployed), demonstrated efficiencies, and management discipline of the private sector (11). Specific building blocks of DOE's privatization strategy are:

- A clear and accurate work definition sufficient for fix-pricing the work.
- DOE defines "what" needs to be done; contractor determines "how" to do it.
- DOE management without meddling.
- Competition to help ensure fair prices.
- Privately financed contractor-owned and operated facilities.
- Requirement of fixed prices or fixed-unit price contracts.
- Payment only on delivery of satisfactory product or service.
- A well-defined regulatory environment.
- Privatization contract directly with DOE instead of through site contractor.
- Equitable risk allocation and shifting as much performance risk as possible to contractor.
- Use of life cycle costs as compared to traditional contracting approaches.
- Establishment of well-defined interfaces with the site contractor (11).

The objective of a privatization contract is "to achieve economically efficient and manageable risk allocation, with the party most able to control or manage the uncertainty assigned contractual responsibility for a particular risk." All projects within EM have some level of risk or uncertainty. DOE's goal under privatization is "for the contractor to assume a far greater share of risks, particularly those under the contractor's control such as technology performance and operating efficiency" (11). To achieve this goal requires that DOE adopt an optimal contracting approach.

This approach is "identified based on past experience, analysis tools, and a clear understanding of the project characteristics, end-state objectives, and the context and constraints for [each] project" (11). To optimize its privatization strategy, DOE must carry out its procurement with careful and thoughtful planning. Significant disadvantages can occur in attempting to lock down fixed prices too early. These disadvantages can become project uncertainties or uncharacterized risks, which translate into costs to the government from higher financing and contingency margins (11). At the same time, as contractors seek to maximize profits under EM's privatization initiative, prudent project management becomes critical. Excess support and costly delays are encroachments on a project's profitability. EM has a responsibility to ensure contractors do not compromise risk management to increase their profitability.

According to JIEE, privatization, coupled with constraints in the 2006 Plan, "will markedly transform the administration of risk reduction and risk management within EM." For the first time, privatization will establish a direct link "between risks to the environment, safety, and health (ES&H) and financial risks to [contractors] and to DOE" (12). JIEE notes this will force EM to deal with two tradeoffs that it has never specifically confronted before. First, it must manage a tradeoff between "allocations of program dollars and terminal risk reduction achieved through clean-up and closure." This involves balancing dollars spent on managing interim risks with dollars spent on reducing terminal risks (12). Second, EM must manage a tradeoff "its private contractors may face between lowering clean-up costs [for greater profitability] and engaging in responsible risk management practices" (12). To satisfactorily deal with these tradeoffs, EM must "adopt a benefit-cost mentality that recognizes tradeoffs between risks and dollars. . . . This, in turn, requires taking into account the motivations behind private sector behavior and making use of financial and market incentives to reduce costs while ensuring responsibility" (13).

OUTCOME-ORIENTED RISK MANAGEMENT

In implementing its mission, EM must make "choices regarding three risk inventories: risks in storage, risks in treatment, and risks in disposal" (14). JIEE defines "risk inventory" for EM as the "expected value" of damage caused by hazardous and toxic materials "at any point in time." Without efforts to control these materials, the "risk inventory" would increase over time as the contaminated material leaks or otherwise breaches its containers, migrating into and over larger areas (15). Environmental and other regulations addressing risk inventories tend to be process-oriented (describing the steps for preventing harm) instead of outcome-oriented (describing the outcome, in terms of risk levels or risk reduction, that must be achieved) (16). This is so because the regulations were established to "regulate a large number of relatively small waste streams . . . throughout the nation, for which individual studies to measure and target risk levels would not be cost effective, and for which parties to cleanup were typically adverse to spending large sums on cleanup" (14). The uniqueness and size of the EM waste management problem, as compared to smaller waste streams throughout the nation, make it more compatible with outcome-oriented risk planning. According to JIEE, EM requires a "specific, risk-based planning system to design a cleanup

based on a 'desirable' path for the risk inventory over time, rather than a prescriptive set of activities that define proper inputs, while ignoring outputs" (14).

JIEE proposes that outcome-oriented risk planning provides a "systematic means" for EM to analyze, manage, and communicate activities related to risk. Specifically, JIEE notes that outcome-oriented risk planning would "(1) restate EM's primary mission in output terms, as the control and reduction of the threats that legacy wastes pose to people and the environment, (2) organize key choices around specific goals, and (3) focus stakeholder dialogue on risk-related tradeoffs" (17). Risk communication should focus on dialogue around specific risk management plans that would gain flexibility over prescriptive regulatory requirements (18). Instead of conducting cleanup according to a "prescriptive set of activities that define proper inputs, while ignoring outputs[,] [o]utcome-oriented risk planning would [create] new, risk-based goals as the primary EM mission, recognizing the constraints that cleanup must respect, and choosing activities to ensure that the [goals are] accomplished to the highest degree . . . constraints permit" (16). According to JIEE, "[t]he goal of output-oriented risk planning is not to lower standards, but . . . to improve cost-effectiveness in delivering an agreed upon product" (18).

BENEFITS AND CHALLENGES OF OUTCOME-ORIENTED RISK MANAGEMENT

Implementing an outcome-oriented risk planning process can benefit DOE EM in several ways. First, EM, as a federal program subject to congressional appropriations, "is bounded by targets, time frames, and budgets" (19). Focusing on specific goals would help EM understand "how to accomplish the most cleanup with limited resources over a limited time frame" (19) and thereby enable it to become a better steward of both the environment and taxpayer's money.

Second, an outcome-oriented risk planning system would enable DOE EM "to identify, evaluate, and force tradeoffs, [such as] choosing goals, choosing alternatives to meet goals, negotiating compliance agreements and other aspects of the cleanup with stakeholders and/or regulators, and allocating budgets across sites and time periods." This would focus EM and its choices on a precise outcome or end state it hopes to achieve as well as on risks that are inherent to achieving that outcome (19).

Third, a risk management planning system could provide a direct way to relate budgeted activities to end states. Fourth, implementing an outcome-oriented risk planning system could provide a metric for program evaluation as well as a way to compare progress toward meeting goals that budgeted dollars buy at different facilities in the DOE complex (19).

Major challenges to an outcome-oriented risk planning process include the current regulatory environment that is generally more concerned with process rather than product. However, as noted by JIEE, experience shows that when stakeholder interests are served, regulators become more flexible. Also, risk data to fully implement a risk planning process are currently nonexistent. However, JIEE believes the current data base can be refined to meet analytical requirements of an outcome-oriented risk planning process (20).

IMPLEMENTING OUTCOME-ORIENTED RISK MANAGEMENT

As stated, risk management focuses on three types of risks: terminal (risks remaining after 2006), interim (risks from hazardous lands or materials until treated), and clean-up safety (risks from the clean-up itself) (8). While terminal risk reduction is a primary clean-up goal and is necessary to ultimate program success, "[c]ost-effective, risk-based clean-up requires balancing dollars spent on each risk category" to achieve the best possible result (8).

According to JIEE, in implementing outcome-oriented risk management, EM must recognize not all cleanup projects are appropriate candidates for privatization. JIEE notes that "[p]rivatization requires compatibility with fixed-price contracting" (21). However, initial incompatibility with fixed-price contracting should not automatically "disqualify" a project from consideration for privatization. In such instances, DOE should review the project to see whether the technical uncertainty associated with the project can be reduced. To reduce uncertainty, a project can be divided "into smaller components with less uncertainty or into components that systematically reduce uncertainty in subsequent tasks" (23). This division can be approached in either of two ways. The first approach involves dividing a project "into segments along its life cycle, such as characterization, treatment, transportation, and storage." Risks are qualified or quantified within each of the segments, thus reducing the overall uncertainty and making the project

more compatible with fixed-price contracting. The second approach, which focuses on the life cycle of a technology from development to production, involves determining whether "a technology is sufficiently mature to be subject to contractual requirements" (23).

When two parties enter into a fixed-price contract amid significant uncertainty, courts can, through constructive change, convert the fixed-price contact to a cost-plus contract.[d] However, such constructive change increases overall costs and negates any cost savings achieved by privatization (21). JIEE maintains that "[b]ecause technical risks translate directly to financial risks and in turn to greater terminal risks, there is strong justification for [defining projects] to emphasize opportunities for cost reduction" (21). Therefore, it is extremely important that DOE, in evaluating a project for privatization, carefully scrutinize the project or phases of the project, particularly for compatibility with principles inherent in fixed-price contracting. JIEE notes that "[e]ven when a compatible contract can be written, contractors will demand compensation for assuming risk that might be avoided through proper management. Typically this means dividing larger projects into smaller ones according to logical sequences, a practice [termed sequencing]" (22). However, sequencing should not be applied in a "cookbook" fashion; it should be adaptable to help make otherwise incompatible projects more compatible with fixed-price contracting (21). Addressing compatibility and sequencing will lead to better planning and overall more effective and efficient cleanup (21).

PROCUREMENT STRATEGY

According to JIEE, once a decision is made to privatize a project or segment of a project, a procurement strategy must be developed. This procurement strategy consists of two parts: preparation and issuance of a Request for Proposal (RFP) and development of an acquisition process for competitively selecting a low-priced bidder. To ensure that ES&H risks are adequately allocated and addressed, the RFP must describe a contracting process that provides incentives for the contractor to act responsibly regarding ES&H concerns (24).

Also, in furtherance of its privatization goals, EM must ensure ES&H risk management is indirect, rather than direct (24). Management of ES&H risks should occur through use of contract terms that provide penalties as well as incentives for compliance with ES&H requirements and that are self-enforcing. If EM's privatization initiative is to be effective, EM must, as much as possible, "adopt an arm's length approach to contract management in general and ES&H risk in particular." EM must act as a buyer instead of a partner (24).

Under its Integrated Safety Management (ISM) program, DOE is strengthening its capabilities and commitment to protect the safety and health of people who live at or near its facilities. Among other initiatives, DOE has completed a rulemaking to help ensure contractors fulfill DOE's ISM expectations and excellence in safety performance. In particular, revised DOE acquisition regulations are being published as a final rule that, among other things, will hold a contractor's fee at risk in the event of poor safety performance. Coupled with contract reforms over the past year, ISM will be a central part of all of DOE's contracts, from the RFP to the contract performance review (25).

Regarding DOE's procurement process, JIEE stresses that DOE's traditional process for soliciting bids by negotiation or "first price auction" "will *fail* to achieve EM's goal of ensuring contracts are let to least-cost, qualified contractors at the lowest possible price" (24). To meet this goal, JIEE suggests DOE should adopt a procurement process that "[provides] bidders with incentives to bid low because of competition with rivals" (24). At the same time, EM must be prepared to deal with the reality that "a fixed-price contract, negotiated because technical terms could not be sufficiently fixed to support price competition, will probably not be delivered as originally priced" (24).[e]

JIEE notes that developing self-enforcing, incentivized RFP terms[f] and a more effective selection process would require EM to allocate more resources to planning. Allocating more resources to planning, however, should be "more than offset" by a reduction in EM's efforts to manage privatized contracts (24). In administering its procurement process, EM should be aware that its actions in dealing with contractors are signals to potential contractors regarding EM's expectations and dealings. In essence, EM's procurement actions will become precedent on which future contractors will base their strategy (26).

ALLOCATION OF RISKS AND OPTIMAL CONTRACTING STRATEGY

Allocation of risks is a new culture for defining DOE's dealing with contractors. Allocation of risks has a direct bearing on contractor incentives and ultimately on the total project cost (11). Under its optimal contracting strategy, risks in EM are categorized as follows:

- Technical (programmatic, process performance-related);
- Operational/Business (project management-related, operations-related, site conditions, construction-related); and
- People (procurement-related, political, insurance-related, force majeure and uncontrollable events) (11).

Figure 1 illustrates the relationship of these risks in achieving an optimal contracting strategy.

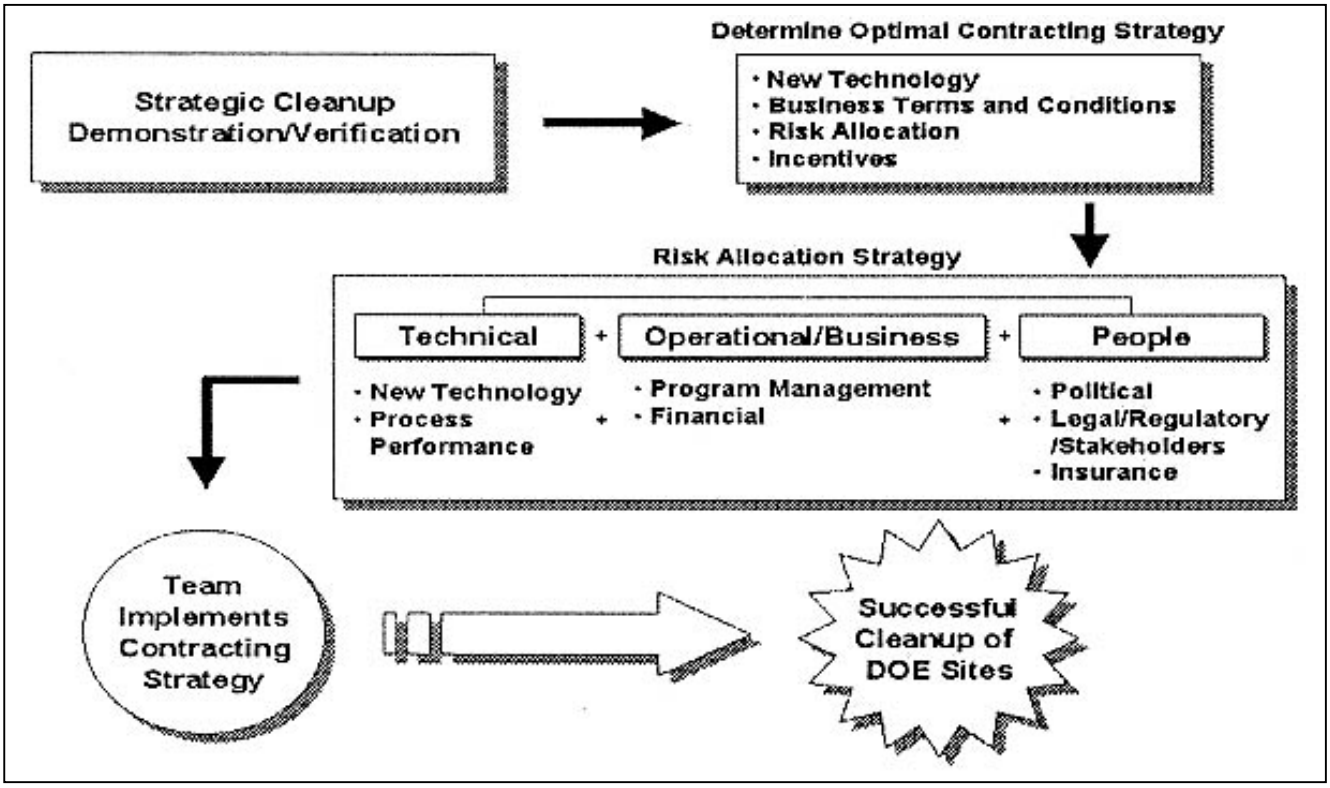

Fig. 1. Risk allocation strategy.

The allocation of risk within EM's optimal contracting strategy "needs to preserve the key benefits associated with private financing, including . . . inherent performance incentives and . . . requirements of third-party lending sources." Having a contractor's money or equity at risk is a strong incentive to complete the project on time and under budget in accordance with performance specifications. Also, the presence of third-party financing imposes additional structure into a project's planning, construction, and operations phases, thereby ensuring a greater likelihood of success within budget (11). Throughout the entire procurement, however, EM must always be cognizant that firms must earn an acceptable level of profits in order to make privatization a viable contracting strategy (11).

Options for government involvement range between the extremes of totally private or totally government financing and must be assessed and applied project by project (27). DOE must be a smart customer and manage a contract to optimize results and not impede progress (11). DOE must strengthen its management approach in interface management (*e.g.*, agreements on responsibilities, schedule, and protocols or "rules of engagement" with both the

private sector contractor and site management contractor). This is critical to success. DOE must clarify its management approach for nuclear, environmental, and safety regulation. Contractors and their financiers require and deserve a "clear picture of the regulatory framework within which they must function." To enhance probabilities of project success, DOE must clarify how it separates management functions from regulatory functions (11).

Historically, DOE EM's Office of Science and Technology (OST) "has worked to establish strong ties between the users of science and technology . . . and technology developers" to address cleanup of the environment (28). Privatization "does not abolish the need for continued government science and technology [S/T] investments; rather, it changes the focus of those investments," *i.e.*, it establishes new rules of engagement (28). As a new focus for S/T for environmental remediation of DOE sites, privatization is a new acquisition strategy for performing work; it does not change the work (28). A goal under privatization is to achieve optimal allocation of risks so neither the government nor private contractors are unduly or excessively burdened with cleanup costs or responsibilities.

As a new acquisition strategy, privatization seeks to allocate risks to the party most able to manage the risks and to obtain the best mix of private and public financing. Under this strategy, the focus is on determining the risks inherent to each project, reaching a consensus on and understanding of identifiable risks, and allocating those risks to party best able and motivated to manage them. Privatization "allows competition and risk sharing to reduce the cost to the government while providing [an approach] conducive for private contractors to turn a profit" (28). Privatization "avoids unacceptable technical risks for government and potential contractors" (28). This is the backbone of the new focus. As noted by one study, "benefits associated with the scope of work must be appealing and must be accessible to a sufficient number of potential bidders to encourage competition" (28). The DOE EM community generally agrees that continued investment by DOE EM in S/T is imperative (28).[g] The exact nature of that research is being debated as EM moves into the 21st century. However, privatization establishes new challenges to OST's continuing efforts to effectively link its investments in S/T with users (28). Figure 2 shows the market segment for environmental compliance, pollution control, and remediation from 1970–2010.

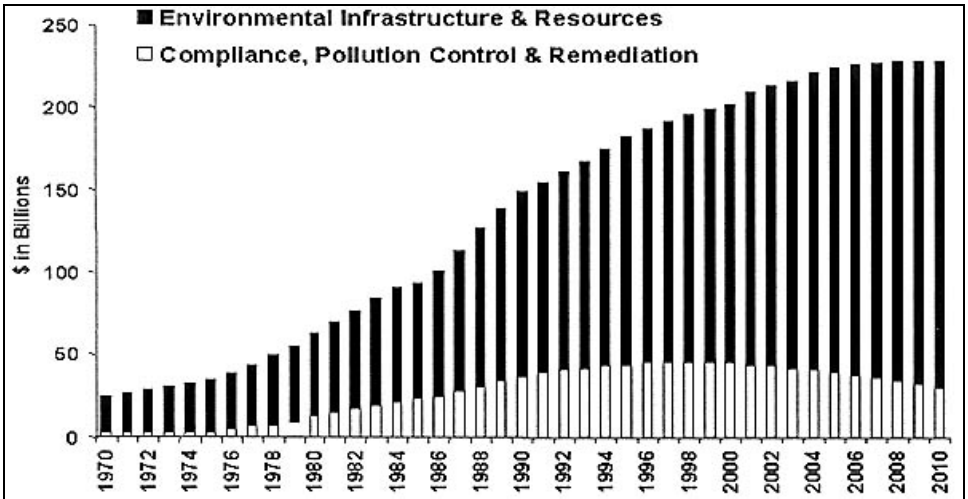

Figure 2. The U.S. Environmental Industry 1970–2020. *Source*: *Environmental Business Journal*®, XI(7), Overview 1998.

FINANCIAL ASPECTS OF RISK ALLOCATION

Today, approximately 90% of DOE's cleanup work is contracted to the private sector (29). With privatization, DOE's objective is "to transfer greater risk to private contractors in return for incentives that align contractor performance with DOE's objectives" (30). With contract reform, DOE is striving to change the way it does business by replacing outmoded and burdensome contracting practices with better methods, focusing on best practices and

expertise from the private sector. Together, both initiatives illustrate DOE's innovative and progressive efforts to capitalize on technical and market forces to conduct its work more efficiently and thereby reduce overall costs (30).

In 1992, DOE established the Tank Waste Remediation System (TWRS) to address cleanup of tank waste at the Hanford Reservation in Richland, Washington. In 1994, as part of its privatization and contract reform initiatives, DOE determined that certain functions of TWRS were compatible with privatization. Thus, DOE began developing a TWRS privatization strategy, concentrating on a commercial transaction model that recognizes "constraints and challenges associated with a single customer facility operating in a federal complex" (30).

Fundamental to this effort has been the effective transfer of risks "to the private contractor for its performance in return for the ability to earn a market incentive commensurate with such risks" (30). With TWRS, DOE's objective was to structure the contract whereby the contractor would be paid only upon delivery of services (30). By its basic premise, this approach necessarily involves using private financing (30). However, a 1998 study[h] noted that "the elements of the project that make it a good candidate for privatization (*i.e.,* need for risk allocation) also make it difficult to finance" (30). Generally, according to the study, a project's technical risks, frequently complex and difficult to estimate, are borne by project participants rather than the lender. Consequently, government debt support is often an integral part of a project's financial structure (30). Achieving the best mix of private and public financing, however, is a goal of DOE's optimal contracting strategy. As technical risks are reduced by increased characterization and quantification of waste streams within the DOE complex, government debt support should become less important, replaced by private financing.

Basically, the method and extent of government financial participation "depend on unique requirements of [a] project and should serve to enhance the ability to raise private financing and lower . . . project cost to the government" (32). To determine the appropriate role for the government and an optimal contracting approach, the government's objectives in the project need to be clearly defined and understood. Once this is done, the government must analyze and determine the optimal risk allocation structure, which should include an appropriate mix of private and government financing to maximize a project's efficiency while meeting the government's objectives for privatization (32).

According to the 1998 study, "[t]he case for private financing can be made by examining the inherent incentives associated with the private finance approach, the requirements of third-party financing sources and the contingent liabilities associated with government financing" (30). First, with private finance, the government is able to "negotiate built-in incentives associated with having a contractor's money at risk" (30). The study notes that "if the project were to underperform or fail, [the contractor and his equity providers] would risk losing [their] entire equity investment or receive lower than anticipated returns." Along with performance guarantees, this is a strong incentive for the project to be completed on time and under budget according to performance specifications (30).

Second, the study states that "[t]he presence of third-party lenders and investors adds additional perspectives and interests to a project's structure." To protect their investment, lenders monitor project performance and often require "very specific terms and conditions in contract documents" (30). This additional project oversight imposes additional structure into the project's planning, construction, and operation phases (30). Third, the apparent cost advantage of government financing is illusory. According to a World Bank paper published in 1996, "under government finance, the taxpayers bear a contingent liability, which if properly remunerated, would wipe out any cost advantage of sovereign borrowing" (31). "In other words," the 1998 study states, "the true cost of government financing is not reflected in the interest rate and budget authorization estimates and often will not show up at all in economic analyses of a project" (31). The study concludes that "just as an insurance company experiences claims on risks it covers, the government will experience the cost of absorbing this contingent liability" (31).

In financing facilities constructed under a privatized contract, private companies often utilize a project financing approach rather than corporate borrowing (30). With "corporate borrowing," lenders look to the borrower's balance sheet for loan security. With "project financing," lenders look to the performance of the project for payment rather than the borrower's balance sheet. As noted by the 1998 study, "[s]ince the lender cannot look to the borrower's balance sheet for loan security, it will look to the project's structure and analyze the project on a stand-alone basis" (30). This analysis involves

- an identification of all transaction risks;
- a determination of whether the risks are manageable;
- an assessment of whether the party accepting the risk is able to do so; and
- an appropriate allocation of uncovered risks (30).

The lender can then use this analysis to determine (1) whether to lend to the project, (2) how much interest to charge, and (3) when to expect payment of principal and interest (33).

In a project financing approach, "contracts create the underpinning of the security for project debt. As such, the agreement between the government and the prime contractor allocates key risks and form the linchpin of the entire transaction" (34). To effect an optimal allocation of risks that results in least cost to the government requires that risks be allocated to the party best able to manage the risks. At the same time, risk allocation directly impacts the financial feasibility of a project. Placing too much risk or unmanageable risk on a contractor or having unknown or unquantified risks may jeopardize or void the contractor's ability to secure private financing (35).[i] To mitigate a lender's concerns regarding risks, a contractor has several options, including (1) finding alternative sources of financing (additional equity or subordinated debt), (2) obtaining insurance to cover specific risks, or (3) guaranteeing a portion of the debt with its balance sheet (36). Structuring a contract to achieve optimal, practical allocation of risks optimizes the economics of a project by ensuring private financing is available, cost savings to the government are effected, and cleanup is achieved.

UNDERSTANDING THE ENVIRONMENTAL MARKETPLACE

To be successful in the new culture utilizing customized optimal contracting strategy to clean up its sites, DOE must understand the domestic environmental market and the demands identified by and within that market. In 1998, $189.8 billion in environmental industry revenue was generated by U.S. companies worldwide (37). In 1996, expenditures on site remediation by DOE were $1.6 billion, 26% of the total U.S. remediation market and over 45% of the government total of $3.5 billion (38). In 1998, expenditures on site remediation by DOE increased to $1.85 billion or 30% of the total U.S. remediation market (39). Figure 3 shows trends and projections of the domestic site remediation markets from 1996 through 2002.

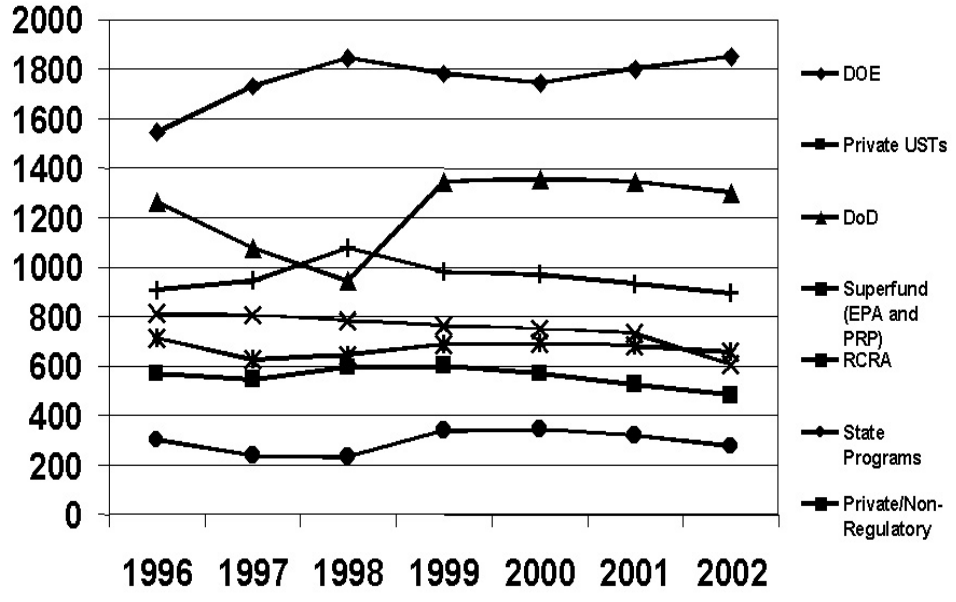

Figure 3. Trends and Projections in Domestic Site Remediation Markets, 1996–2002. (dollars in millions) *Source: Environmental Business International, Inc.*, Report 312B, 1997.

Growth by DOE in the domestic site remediation market is expected to continue for several reasons, including continued justification for funding DOE's environmental technology development programs, public concern over radiological contamination at DOE sites, and DOE's focus on cooperation between industry and government (40). Similarly, DOE funding to commercial subcontractors is expected to increase 4 to 6% through 2000, with gains continuing for the next 10–15 years as facility decontamination and decommissioning projects fill in when site remediation activities begin to dwindle (41).

U.S. environmental industry exports of goods and services continue to grow. In 1997, the U.S. experienced a trade surplus in environmental exports and held a 6.3% share of the $291 billion non-U.S. market (42). In 1998, total U.S. environmental industry revenues increased to $189.8 billion, a 2% growth over 1997. Exports of goods and services increased to $18.8 billion, accounting for approximately 10% of total U.S. environmental industry revenues (37). While the U.S. environmental industry experienced 2% growth in 1998, available preliminary data indicates that the total non-U.S. market for 1998 decreased to about $259 billion out of a total global market of approximately $445 billion. However, the preliminary data also indicates that the U.S. share of the non-U.S. market for 1998 increased to 7.3% (43). (See Figure 4.) According to one Environmental Business International, Inc., analyst, "[t]he U.S. share [of the total market] runs about 40–42% each year, depending on the relative growth [of the U.S. economy as compared to other economies]. Our economy has been the healthiest . . . for the last several years, so the U.S. share [of the global market] has crept up" (43). U.S. companies are more successful in exporting equipment (particularly water/wastewater equipment and instrumentation) than services (42).

Regarding venture capital investments, the environmental sector benefited from only 1.6% or $208 million of the $13 billion total U.S. venture capital investments between 1992 and 1994 (44). Evidencing further erosion of environmental venture capital investments is that environmental venture capital fell drastically from its $94 million peak in 1992 to $29 million in 1995 (45). In 1997, environmental sector investments by venture capitalists rose to $42.9 million. However, 70% of this amount was accounted for in a single $30 million investment. At the conclusion of the first three quarters of 1998, only $12.1 million in venture capital environmental investments was reported (46).

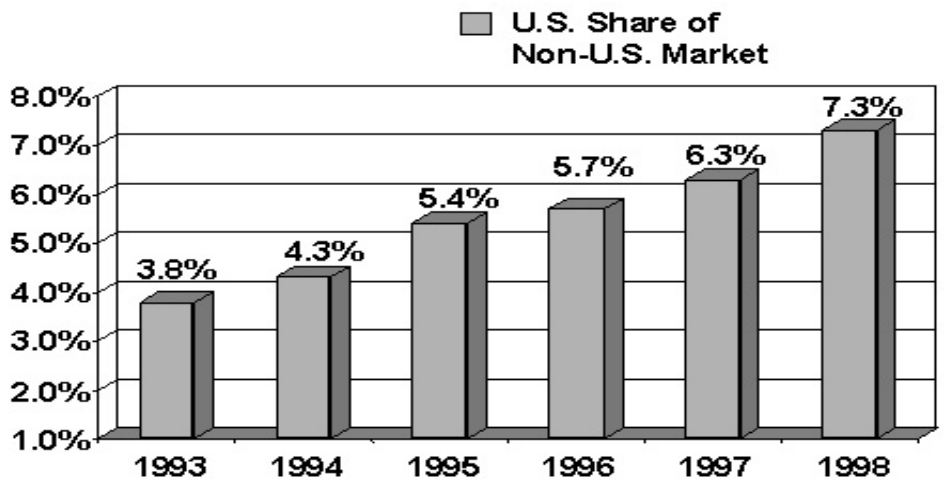

Figure 4. U.S. Export Performance as Share of Global Environmental Market. Estimate for 1998 is based on available preliminary data. *Source: Environmental Business Journal*®, XI(7), 1998.

CONCLUSION

As DOE EM enters the 21st century, its primary mission remains unchanged: to clean up sites contaminated with radioactive, chemical, and other hazardous wastes from more than 50 years of U.S. government nuclear operations,

particularly weapons production. Cleaning up contaminated sites across the DOE complex is an enormous challenge and responsibility. At the same time, however, this challenge and responsibility gives DOE EM a tremendous opportunity to identify and adopt innovative ways of conducting its cleanup mission. To effectively and efficiently accomplish this mission in the current era of reduced funding and increased accountability, DOE must adopt a cleanup strategy that seizes the best practices and expertise of private industry and capitalizes on optimal allocation of risks among all project participants. This requires DOE to move beyond the past in addressing its mission. Traditionally, DOE EM has focused on technical risks. However, lessons learned from TWRS and other privatization initiatives have shown that technical risks are not to be dealt with independently of other risks. They are directly related to other risks, categorized primarily as operational/business (including financial) and people risks.

Because of the immense size and technical complexity of many of DOE's cleanup projects, financial risk becomes a major driver. Therefore, to achieve the goal of an optimal contracting strategy, financial risks must be balanced with other risks, particularly technical risks. To devise an effective cleanup approach using improved project management and tailored contracting strategies not only requires all risks to be addressed but that they be addressed as an integrated composite. Balancing financial risks with other risks will result in a tailored contracting approach throughout the DOE complex, one that uses a financing scheme—whether government, private, or a mix—that is most appropriate for addressing and allocating all risks at each individual site. When these types of risks are considered comprehensively, the end result is an optimal contracting strategy that meets DOE's cleanup needs with less cost to the government.

Within the environmental management industry, DOE's remediation market has not been well-defined. Most recent data shows DOE's site remediation expenditures to be 30% of the total U.S. remediation market (39) with major remediation activities scheduled to occur in the next six years. At the same time, limited funding makes it imperative for DOE to identify and provide better incentives to promote and accomplish its mission. As the nation moves into the 21st century and a new millennium, the challenge confronting DOE in meeting its primary mission of environmental cleanup is to support improved project management and to creatively allocate *all* risks into an optimal contracting strategy.

FOOTNOTES

[a]The Regulatory Philosophy, described in Section 1.a of Executive Order 12866, states: "Federal agencies should promulgate only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling public need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being of the American people. In deciding whether to and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health, and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach."

[b]These reports are available at JIEE's website (http://www.jiee.org).

[c]According to JIEE, "compatibility means that a project's technical uncertainties must be definable with sufficient clarity so that a fixed-price contract can be managed as written. . . . [U]nless contracts are compatible, the legal doctrine of constructive change makes judicial remedies available to the private contractor which will effectively convert fixed-price contracts to cost-plus contracts." (See Bjornstad, David J., *et. al*., *Risk Reduction and the Privatization Option: First Principles*, The Joint Institute for Energy and Environment, Knoxville, TN, September 22, 1997, page 7.)

[d]According to 48 CFR § 16.202.2, firm fixed-price contracts are appropriate "when the contracting officer can establish fair and reasonable prices at the outset." As discussed by JIEE in Appendix D to *Risk Reduction and the Privatization Option: First Principles* (see generally pages D-12 through D-14), a constructive change is one "that a contractor argues . . . he has to make even though he has not been issued a written order under a changes article"

(citing W. Noel Keys, *Government Contract in a Nutshell*, page 443). Constructive changes are the result of "action or invitations by Government personnel that are construed by the contractor to be a change to the contract." Such changes occur when (1) work is done beyond the basic contractual requirements, (2) the government required the contractor to perform additional work not required by the contract, and (3) the government was notified of the change by the contractor (citing *Consultants, Inc*., ICA 79-2, B.A. 13,527). Based on the doctrine of constructive change, the Changes Clause in government contracts allows the government to "unilaterally make changes in work within the scope of the contract [and] authorizes an equitable adjustment if the change increases or decreases the cost or time of performance" (citing *Thermocor, Inc. v. United States*, 35 Fed. Cl. 480 (1996)). However, the Changes Clause does not permit a cardinal change, which "is a substantial deviation from the original scope of work that changes the nature of the bargain between the parties." When such a change occurs, the entire contract will be reviewed to determine which party is responsible for the change, and courts will make an equitable adjustment. An equitable adjustment can be made when changes to the contract involve, for example, work scope changes; late or deficient information, material, or equipment; stop work orders; defective or deficient specifications; directed, out-of-scope work; delays caused by the government; overly stringent or untimely inspections; or acceleration of work. Contractors often assert a claim where the contract requirement language is ambiguous and subject to interpretation or where the facts concerning non-conformance to contract requirements do not exist, are deficient, or are otherwise defective. When an event occurs that impacts contract performance, the contract will be examined to determine whether the impact was anticipated and whether language was included to deal with all implications of the impact. If the event was anticipated, the contractor must follow the contract's specified procedures; if not, the contractor must follow the specified general procedures for changes to the contract usually outlined in the changes clause in government contracts. This clause specifies the procedures to be followed in preparing and presenting change requests. Finally, the contract will be reviewed to see whether the contractor justifiably relied on contract estimates, standards, or specifications. If the contractor justifiably relied on the government's specifications and those specifications were wrong and the parties cannot resolve the matter, the courts will permit an equitable adjustment.

[e]E.g., Tank Waste Remediation System (TWRS). In September 1996, DOE contracted with two contractor teams—one led by BNFL, Inc., and the other led by Lockheed Martin Advanced Environmental Systems (LAMAES)—for the first of two phases to clean up tank waste at DOE's Hanford Site in Richland, Washington. Phase I is a commercial demonstration to treat approximately 10% of the total tank waste by mass; Phase II consists of full-scale treatment of the remaining 90% of wastes. Phase I consists of two parts: Parts A and B. Deliverables for Part A, which involved an evaluation of the technical, operational, regulatory, business, and financial elements required by privatized facilities that would provide treatment and immobilization services on a fixed-unit-price basis, were delivered in January 1998. At the conclusion of Phase I, Part A, neither contractor was willing to commit to firm fixed prices without adding significant contingency to their prices. Both contractors maintained that better definition and quantification of project risks were required before they could make the corporate commitments necessary to put their financial resources at risk and attract third-party financing. DOE decided that the level of uncertainty with respect to design, financing, and regulation at the end of Part A was such that fixing prices would require an excessive price to compensate for the risk faced by the contractor. Thus, a design phase (referred to as Part B-1) was defined to reduce this uncertainty and to provide DOE with various reviews and decision points before proceeding with construction and operations phase. This design phase will allow time to verify technology performance on Hanford-specific wastes and to optimize debt and equity arrangements and technical requirements.

[f]In discussing incentives, JIEE states that "EM can influence incentives through the structure of the procurement process, including the nature of the contract and the bidding rules. . . . The government can structure the incentives of the procurement process in two general ways: (1) by the contractual terms it defines through the request for proposal and ultimately through its contract with the [private] firm; and (2) by the way it structures the procurement process to influence the behavior of the firm in the bidding process. These two steps must be consistent: carrying out one competently without considering the other will fail to obtain the best possible price." JIEE continues by stating that efficient contract management practices involve converting non-price contract terms to price terms, "such as through penalties or bonuses." This allows DOE "to pursue non-price goals within the structure of a fixed-price contract." (See Bjornstad, *et. al., Risk Reduction and the Privatization Option: First Principles,* The Joint Institute for Energy and Environment, Knoxville, TN, September 22, 1997, pages 12–13, 26.)

[g]While the authors, who work at the Hanford site, do not specifically say why the DOE EM community would be in agreement with this statement, they do state that "[i]nvestments in science and technology by the government . . . and

by industry have been critical to the success of the privatization approach being pioneered at the Hanford Site." They then continue their discussion by focusing on four important ways that science and technology support successful privatization.

[h]This study, *Impact of Technical Uncertainty on Private Financing of Federal Waste Clean-up Projects*, was sponsored by the Department of Energy, Richland Office, Tank Waste Remediation Systems, Waste Disposal Division.

[i]See, *e.g.*, the discussion of TWRS in Footnote e.

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