DEPLOYING INNOVATIVE TECHNOLOGIES TO IMPROVE DOE D&D PROJECT BASELINES

Robert W. Rose
Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439

May 1997

To be presented at the "Decommissioning, Decontamination and Reutilization of Government and Commercial Facilities" meeting to be held in Knoxville, TN, September 7-12, 1997.

DISCLAIMER

DEPLOYING INNOVATIVE TECHNOLOGIES TO IMPROVE DOE D&D PROJECT BASELINES

Robert W. Rose
Argonne National Laboratory
9700 South Cass Avenue
Argonne,, IL 60439
(630) 252-8671

ABSTRACT

The insertion of innovative technologies to replace baseline technologies used in cost estimation and planning of DOE D&D projects is considered a high risk endeavor by project and programmatic decision makers. It is almost always considered safer to go with the "devil you know" than use a new or untried technology, methodology or system. The decision on the specific technology to be utilized to remediate a problem is often made months or years in advance of execution, and the highly proscriptive documentation of agreements necessary to obtain stakeholder and regulator approval of remedial plans is often counterproductive to considering improved technologies.

There are many deterrents to the deployment of innovative technologies and untried methodologies. These barriers can be categorized into four general areas:

A. Lack of Technical Basis and Benchmarking Information
B. Administrative Inertia
C. Institutional Infrastructure
D. Insufficient Emphasis on Long Term Return on Investment

This paper will present some real-life experiences obtained in the CP-5 Large Scale Demonstration Project and provide recommendations on how to minimize and, in some cases, overcome these institutional barriers to innovative technology deployment.

I. BARRIERS TO DEPLOYMENT

A. Lack of Technical Basis and Benchmarking Information

With any new technology, whether in the commercial products sector or in government remedial activities, the individual responsible for purchasing needs to feel a certain level of comfort in trying a product or service for which he has little or no experience. Convincing qualitative and quantitative data on the technology's performance and limitations are necessary to minimize the buyer's concerns related to untried methods. This data should come from a reputable source, independent of the vendor or distributor of the technology, to allow the buyer to feel a high level of confidence in its accuracy and completeness.

The current D&D market is relatively small, but growing. With the relatively small scale of D&D field operations currently going on, it is difficult to perform the type of data collection and demonstrations which would give technology buyers the level of comfort they would like to have when trying new methods. And because the market is small, there is a lot of competition in the deployment of current technologies, which leaves little room for innovative technologies to get their foot in the door.

Any new technology is designed to meet some predetermined performance specification. These performance specifications are usually predicated by a certain set of assumptions based on a standard or assumed application. Normally, a technology developer would then set out to develop a product or system to beat these predetermined performance indicators.

The lack of predefined performance indicators based on specific problems prevents the technology developer from taking a holistic view of the problem he is developing a technology for. In nuclear and radiological facilities there are many disqualifiers which will preclude the use of a technology, even if some or most of the performance indicators are substantially improved upon. Since technology developers are often specialists in their chosen field, a systems approach must be utilized to ensure the end product is useful to the individual who is buying the product or service. The seeming lack of complete performance indicators for a given technology based on actual problems often leads the technology developers into developing an improved technology with no real-world application.

Another significant detractor from the development of standard performance indicators is the uniqueness of the facilities within the DOE Complex. The technical basis for the successful deployment of a technology in one facility, with one specific application and set of problems, could be totally different for another facility. The 1996 Baseline Environmental Management Report (BEMR) indicates that there are 3,500 contaminated facilities in the DOE Complex which are either surplus or expected to be surplus in the next ten years. The report further indicates that only 100 have been completed to date. With only 3% of the scope of the DOE decommissioning program, and only a handful of commercial-sector D&D projects complete, there is little real world-data to draw from related to performance indicators for baseline technologies. Only a few of the DOE and commercial-sector D&D projects completed to date have attempted to collect the type of means information necessary to set benchmarks, and many of these have been retrospective. The common practice is to use commercially available construction means and apply productivity factors based on the expected environment the job will be performed in. These extrapolations may be sufficient for "order of magnitude" budget planning but fall short for proposal quality estimates.

B. Administrative Inertia

Even if there are sufficient data to show an improvement of the cost and schedule baseline and that the technology will meet the performance specifications, administrative requirements associated with revising previously agreed upon methodologies and processes can oftentimes be more cumbersome and costly than the potential savings associated with implementing the new technology. Having explicit, detailed plans for remediation activities reviewed by decision makers, stakeholders and regulators far enough in advance to allow long-range budgeting and planning hinders the insertion of potentially improved technologies. The current process of having all potentially affected parties involved in the decision process comment, and in some cases approve, remedial plans presents a significant deterrent in revising and modifying these plans based on new technological developments. Once agreed upon by all interested parties, it is extremely difficult to bring the "players" back to the table to revisit a plan. This process is cumbersome at best.

In addition to the review and approval process, the current funding methodology contributes to administrative inertia. If a technology passes all of the other obstacles and is ready to be deployed, budget and cash-flow issues must be dealt with. Since funding requests are made at least two years in advance and detailed cost plans are negotiated and agreed upon in the Current Year Work Plan authorization process, an innovative, cost-saving technology will require a revision to previously contracted earned-value performance measures. If the cost savings of a new technology are great enough, the disincentive of potential carryover must be addressed. Since carryover is normally considered a negative performance indicator, regardless of whether it is due to cost savings or schedule slippage, additional work scope must be ready to execute to cost these newly available funds. The added burden of maintaining a rigorous cash-flow management system results in a disincentive to taking a risk to save money.

C. Institutional Infrastructure

With the deployment of technologies which affect, or could affect, site-wide services, there is often a lack of understanding and/or appreciation for the ripple effect in the support areas. A technology for improved site-wide laundry services or waste-water treatment cannot be looked at from the perspective of cost/suit or cost/gallon unless there is a clear understanding of the overhead and indirect support costs associated with both the baseline and innovative methods. The issue on new technologies is that the baseline infrastructure is clearly understood, but until implemented, the innovative technology represents a high risk in the area of maintenance and indirect support.

There is usually a considerable investment in facilities, equipment and personnel training for site-wide services and support systems. To replace baseline services with innovative service technologies often requires redundant support for the period of implementation. Once implemented, the facilities, systems and personnel associated with the baseline

services must be addressed. These post-implementation issues, while seemingly insignificant, require considerable management attention and effort. The most problematic is the issue of personnel requirements.

D. Insufficient Emphasis on Long-Term Return on Investment

Even if all of the data clearly indicates an improvement over the baseline and all of the other barriers can be resolved, the appropriations and budget process represents a significant hindrance in deployment of new technologies which require large capital expenditures. Technology development is proceeding at a rapid pace in many areas, and since the operating budgets are normally estimated and proposed at least two years in advance, with little or no contingency or management reserve, there is significant competition for available resources. Since the cost of many of services which stand to be improved by innovative technologies are uninterruptible, there is simply insufficient resources to maintain the service using baseline technology and to design and deploy an innovative method. The time to recover capital expenditures in technology improvements is perceived by many to be the time frame between budget cycles, which is too short for a technology decision maker to risk.

II. OVERCOMING THE BARRIERS

A. Lack of Technical Basis and Benchmarking Information

The lack of technical basis and benchmarking information is relatively simple to solve, but will require a long-term commitment to create quality decision tools.

Current programs in place such as the EM-50 Large Scale Demonstration Project concept and the EM-40 Decommissioning Benchmarking Study provide valuable information which could be used by technology decision makers. The EM-40 Preferred Decommissioning Technologies Guide (Draft, dated July 1996) and the International Atomic Energy Agency's State-Of-The-Art Technology For Decontamination and Dismantling of Nuclear Facilities, when released, can contribute useful information in the selection of technologies and methodologies. However, all of these documents are very generic in nature and do not contain sufficient information to assure a technology decision maker that the technology will work for his application.

The Innovative Technology Summary Reports (Green Books) are excellent examples of the type and quality of information necessary to allow planners and estimators to provide good baseline cost estimates and schedules. The only issue with these decision tools is that not many currently exist. A recent internet search only found thirteen of the Green Books available, and only two of these were related to D&D issues. Expanding the library of Innovative Technology Summary Reports and periodically providing summary comparisons of competitive technologies in each of a few standard "problem sets" would contribute significantly to filling the current void in available information related to benchmarking and technical basis.

In the current D&D market there is little opportunity to collect the quantity of information necessary to have statistically significant means. As indicated earlier, there has been little field operations completed, and these have not been representative of the large D&D jobs of the future. The EM-50 Large Scale Demonstration Projects have been effective in obtaining valuable information related to specific technologies at ongoing project sites. An alternative concept which could be considered would be to have small-scale demonstration of technologies clustered around predetermined problem sets. Many of the issues associated with D&D are relatively generic. Starting from the basis of these generic problem sets, identifying potential technological solutions and then demonstrating these technologies head to head in similar applications and environments will considerably reduce the subjectivity associated with current comparison methods.

In addition to collecting and reporting the requisite information, distribution of the data could be improved. While there is a considerable amount of information available, albeit of limited utility, much of it seems to be stovepiped into very discreet channels. Planners, schedulers, cost estimators and project managers, the people responsible for creating and maintaining baselines, are not normally cognizant of the research, development and demonstration status of new and innovative technologies. Only after a technology has proven itself on multiple occasions and the information related to that technology becomes general knowledge do the planners look at it for possible baseline technology replacement. This time lag is in years, so by the time an "innovative" technology becomes the new baseline, it is no longer very innovative. Rapid dissemination of current information to the appropriate technology decision makers, coupled with an effective incentive program for incorporation into baselines, would provide an effective method to keep baselines current.

B. Administrative Inertia

Dealing with administrative inertia is more problematic than might it might appear. The current environment of inclusiveness in the decision making process has led to greater credibility, trust and overall buy-in in the baseline preparation process, but at the expense of responsiveness to change and ability to adapt to changing conditions, such as technology improvements. While the goals of inclusiveness in the decision making process should continue to be maximized, consideration should be given to changing the level at which these buy-ins are sought.

The overall objective and goals of any environmental remediation project should be a broad-based decision with input and agreement sought from as wide a spectrum of affected parties as possible. The specific methods and technologies to be utilized to achieve those goals should be determined by the people assigned to achieve those goals.

Too much specificity in planning and authorization basis documents hinders the ability of project managers to adopt improved methods, especially if these documents are developed long in advance of project execution. Staying focused on the hazards associated with a project and the envelope necessary to mitigate those hazards should be the goal of planners. While assumptions related to how a hazard will be mitigated will always be necessary, this should not be considered a technology or methodology selection. Providing managers and planners with the sufficient latitude to make decisions in real time based on what is currently available to mitigate a hazard should be considered in preparation of all controlling documents and this should be made clear to regulators, stakeholders and other affected parties.

With the issue of funding and cash flow, consideration should be given to fund multi-year projects through line item allocations. The field work for the average D&D project is two to four years in duration. This relatively short time span coupled with easily definable milestones and performance indicators make these projects ideal for line item funding. The current process of coming back annually to obtain funding and renegotiate deliverables is time consuming and cumbersome. The distraction of annual funding cycles detracts from the goals of optimized project performance.

Significant improvement has been made in the last few years related to project management and earned value reporting tools and many of the concerns related to performance and status tracking have been alleviated. It is time to consider returning to life-cycle funding to allow authorized projects to proceed at the optimal pace and incorporate technological improvements on the fly.

C. Institutional Infrastructure

The most effective method to overcome institutional infrastructure is to minimize it. Many of the services, especially site wide services such as laundry and water treatment, should be considered for privatization and centralization. This will allow vendors with the most cost effective technology to compete for that service. This serves the dual purpose of minimizing investment costs and allows improved technologies to compete as they are developed. Privatization is not a panacea and it is only applicable to those activities and services where specific performance criteria can be identified and per unit costs can be derived. In lieu of privatization, more consideration should be given to incremental technological improvements to existing systems and processes.

D. Insufficient Emphasis on Long-Term Return on Investment

Return on investment is a key factor in considering whether to develop and deploy an innovative technology. To do this properly, the size and timing of the market must be known and understood. In many cases small incremental improvements on baseline technologies can realize significant savings if the size of the problem can be quantified. Breaking the D&D market into needs-based categories and identifying the current technologies and associated cost which will be used to fill those needs will provide much more explicit direction to technology developers. This will also serve to quantify a realistic market-wide return on investment for deploying a specific technology.

The current strategy to look at small, project-specific return on investments leads one to conclude that the cost savings are insignificant relative to the total project, when in fact, the total savings, if deployed complex wide could be large. If market wide technology deployment decisions can be determined, it makes a much more compelling case for investment in the new technology. This will be very valuable in making the case for expending the capital necessary to replace aging and obsolete technology. The horizon for return on investment should be the entire life cycle for the old versus new technology and not the next budget cycle.

III. CONCLUSIONS

There is no single solution to the problems associated with slow deployment of innovative technologies. A robust, competitive market will eventually force improved technologies and methodologies into wider acceptance and utilization. In the currently small, but growing, market, now is the time to establish benchmarks and technology baselines to allow for clearer focus of limited development resources.

The following list provides some recommendations and examples of programmatic policies and directions which could position the DOE Complex well for when the bulk of the D&D scope will begin in earnest, somewhere around 2007.

A. Continue Defining and Clarifying the Needs (Problem-Set-Based Decision Tools)

B. Include More Project/Program Input. Less Reliance on Specialists

C. Omit Details Related to Specific Technology and Methodology from Authorization Basis and Planning Documents

D. Regulators and Stakeholders Should Be Involved in Decisions Related to Goals and Final Outcome, Not How to Get There.

E. Investments In Technology Development Should Be Based on the "Whole Problem". Breaking It Into Component Parts Could Lead to Unusable Technologies

F. Continue (Or Increase) And Improve Quality of Data Collection and Dissemination. (i.e. Innovative Technology Summary Reports, Benchmarking Reports, and Alternatives Matrices)

G. Return-On-Investment Decisions Should Be Based on Complex-Wide Application, Not single Projects or Sites

H. The Basis and Back Up Information Related To the BEMR and Other Programmatic Planning Documents Should Be Widely Available To Technology Developers to Allow Market Based Decisions to Be Made

I. Define and Make Widely Available Market Studies Related to Problem Sets. Consider Incorporating BEMR to Problem Crosswalk

J. Communicate, Communicate, Communicate. Get the Word Out to Problem Holders and Technology Buyers. Communicating With Other Technology Developers Can Be Useful But Cannot Replace Information From the Person Who Has to Deal With A D&D Issue.