DECONTAMINATION AND DECOMMISSIONING
-- IT'S NOT ROCKET SCIENCE --

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INTRODUCTION

The Battelle Columbus Laboratories Decommissioning Project is a cost-share project between the U.S. Department of Energy (90% share) and the Battelle Memorial Institute (10% share) to remove radioactive contamination from multi-use laboratory facilities in and around Columbus, Ohio. Fifteen buildings, or portions thereof, at two separate sites became radioactively contaminated as a result of performance of work under contract to DOE and predecessor agencies. The type and extent of contamination varies from building to building, depending on the nature of nuclear research historically performed. Most of the contamination in laboratory and metal fabricating areas at the downtown King Avenue site is due to uranium, thorium and associated daughter products. The more rural West Jefferson site, location of a large hot cell facility and decommissioned research reactor, also has contamination from transuranics (TRU), mixed fission products, and activation products.

A Project Plan, baseline, and an Environmental Assessment were approved by the DOE (EM-1) in 1990. Initially the project was designated a Major Systems Acquisition, and a validated cost/schedule control system was put in place (in late 1991 the project was downgraded to a major project). Total Project Cost over the ten-year life of the project is estimated currently at about $215 Million.

In the first years of actual clean-up activities (focused on the least contaminated areas) significant negative schedule and cost trends developed. Several assessments conducted in 1992 focused on the root causes of poor performance. Major problems were found to be: 1) insufficient experienced staff in both the contractor's management and implementing organizations; 2) inadequate definition of project scope; 3) lack of detailed planning; and 4) an incomplete body of effective work procedures.

Corrective actions, implemented over a period of 6-7 months resulted in dramatically improved performance. These included a nearly complete change-out of the management team, and an extensive effort to create needed control documentation. In FY 1993, the project turned in cost and schedule performance within 1-3% of the fiscal year plan, and this against some of the most

challenging tasks. The lessons learned on the BCLDP are applicable to much of the remediation and D&D effort across the EM Program. They confirm that basic concepts of project management need to be followed if projects are to proceed safely and efficiently. These lessons also confirm many of the findings of the recently completed Project Performance Study (U.S. Department of Energy, 1993).

EXPERIENCED STAFF

There is no substitute for experience. D&D is basically construction management with a hefty dose of radiation protection, and a higher level of contingency. Staffing should reflect the nature of the work being performed.

The BCLDP Problem

The initial organization put together to manage the decontamination operation had no experience in construction-style activities. The tendency was to treat the project like a research program. This resulted in insufficient planning and attention to detail. Individuals with limited experience and credentials were put in charge of such functions as waste management, radiation protection, and planning. Lack of experience in supervising large numbers of semi-skilled laborers resulted in poor productivity and insufficient attention to safety. Workers were expected to be self-motivated and intuitively knowledgeable of assigned tasks.

The BCLDP Solution

As a result of a major self-assessment, the contractor determined that a new and expanded management team was needed. Positions were filled from outside the organization. Emphasis was placed on skills in construction project management, D&D, and radiation safety. The pool of experienced D&D labor was increased through use of subcontracts to get needed skills. Worker supervision was improved and an incentive management program initiated.

These lessons apply broadly across DOE's environmental restoration program. Whereas workers from many other labor categories can be retrained to be D&D technicians, a PhD physicist will, in all likelihood, make a poor D&D project manager. D&D managers (both within the contractor's organization and the DOE) must have real experience at D&D. This is probably the single most critical element for assuring project success. The best way to increase the pool of project management competency within the DOE is through apprenticeship and mentoring programs.

Most D&D tasks do not require great skills or high technology. However, absolutely essential to good productivity is a sufficient number of 1st level supervisors, the "sergeants" and "squad leaders". These are the individuals with the knowledge and experience to make on-the-spot decisions for maximum productivity. They are the motivators of the work crews, and the monitors of safe work practices.

SCOPE DEFINITION

There is a lot of concern throughout DOE's environmental restoration program about escalating costs. Cost increases and overruns are the result not so much of poor estimating, but of inadequate scope definition. It may sound like heresy; but if you control the scope and the schedule for a project, costs will fall in line. You cannot achieve good project performance simply by focusing on costs.

The BCLDP Problem

The initial scope description for the project was too superficial to allow effective planning and performance. Battelle's assessment of areas and levels of contamination was prepared as part of its claim to the DOE for a clean-up effort. This assessment was based on a number of limited instrument surveys, historical records, and personal communications. Initial clean-up attempts showed that this preliminary assessment was an inadequate basis for establishing the actual level of contamination in different buildings, or for understanding the amount of effort needed to expose the contamination (e.g., removal of furniture, laboratory equipment, and building systems). Lack of a solid database resulted in both underestimates and overestimates of the effort needed to perform D&D. Cost and schedule overruns were common. Change control was obviously difficult because a firm listing of areas needing treatment had not been prepared.

Scope definition also raises the question of how much characterization is needed to determine an appropriate level of decontamination. Obviously this will vary from project to project, and between areas within projects. Factors to consider are: uniformity of the contaminated setting; the level of uncertainty which is acceptable for effective planning; and the relative costs of performing characterization versus decontamination.

The BCLDP Solution

We now have in place detailed scope description documents covering known/suspect contaminated areas as well as support functions (waste management, project control, health and safety, institutional). Where precise information does not exist regarding the distribution of contamination, assumptions are used which reflect previous characterization data and historical information on building use. Contingency is used to address the uncertainty in scope definition. Formal change control is used to add/delete areas from the project baseline, or to modify the scope of activities.

DETAILED PLANNING

The work plan has to be detailed -- if you can't say exactly how a job will be done, who needs to do it, and how long it should take, then you're not ready to start.

The BCLDP Problem

Tasks, such as characterization and simple decontamination, were proceeding in fits and starts. Each effort was being viewed as a totally new initiative, unrelated to previous work (much like a research project). Jobs were not scoped sufficiently in advance to understand the types of equipment or specialty services (e.g., electrician, plumber) which might be required. Work instructions and procedures were lacking in detail, or non-existent.

The BCLDP Solution

Once the project was reorganized, a much more detailed planning effort was put into place, initially focused on the FY 1993 work plan, and later on a revision to the total project baseline. The approach we currently use in planning includes:

1) developing resource-loaded schedules, very detailed for current year plans, less detailed in the out years;
2) integrating project activities in a formal logic network, identifying constraints and critical path;
3) using detailed "basis of estimate" worksheets for each activity, and building traceability into the estimate from top to bottom;
4) forecasting future costs through application of historic cost and productivity data;
5) applying lessons learned; and
6) requiring management readiness reviews prior to each major D&D campaign to assure that all prerequisites to work (hardware, people, and documentation) are in place.

There is a belief in some quarters that it is praiseworthy to bring an activity in "under budget" and ahead of schedule". Actually this frequently is evidence of poor planning and overly conservative estimating. There is pressure to pad our estimates somewhat to give us that "margin of safety". However, every unnecessary dollar that gets locked up in the estimate for one task is a dollar that isn't available for other work. Uncertainties need to be handled through an explicit contingency analysis. Those who would overestimate activity costs

should consider this corollary to Parkinson's Law: "Work expands to fit the available budget."

On the BCLDP we strive for "should cost" estimating. This is an art that comes from experience and careful consideration of all factors affecting a job. Schedulers and cost estimators become an essential part of the project team. We keep an historic database of actual costs and productivity to apply to future task planning. This concept needs to be expanded DOE-wide as an essential component of a lessons learned program.

SOLID WORK PROGRAMS AND PROCEDURES

The goal of any D&D project is to return a building or area to productive use with lesser,or no, radiological restrictions. For the BCLDP, the primary goals are: 1) to remove DOE's liability for residual contamination; 2) to achieve cost-effective performance; and 3) to maintain safe operations. Each of these goals translates into a set of lower level requirements. For instance, removing DOE's

liability for contamination at the site requires a quality program of characterization and verification, using state-of-the-art instruments, with documented procedures, and careful maintenance of all survey records.

The BCLDP Problem

Poorly based technical procedures and outdated equipment in the early phases of the project resulted in characterization data which was suspect. In some cases, areas were characterized two, and even three, times. Workers were learning how to perform clean-up tasks by trial and error. Supervisors were as limited in their skills as the workers they were supervising. The radiation protection program did not meet current DOE requirements as laid out in the RadCon Manual (U.S. DOE, 1992). An awareness of construction safety practices was lacking.

The result was that work frequently needed to be redone, or couldn't be started because DOE was unwilling to authorize work in higher hazard areas. DOE staff were engaged in that most fruitless of all activities: trying to inspect quality and safety into the job.

The BCLDP Solution

During 1992, project procedures were extensively revised and linked to industry standards. Safety and radiation protection professionals were hired to develop and implement a totally restructured safety program. Several technical basis documents were prepared which provided a sound scientific rationale for instrument calibration and survey procedures, and the process for releasing materials and building areas. Extensive retraining of staff took place, following a detailed job-task analysis. Qualifications standards for performing work were established. The work instruction process was improved, and enhanced with a safety checklist. Upgrades were made to both characterization and decontamination equipment.

A well documented set a project plans and procedures is necessary to control the work. However, as we have learned, it is more efficient to have experienced workers than overly prescriptive procedures. A well trained workforce gets the job done more safely and efficiently. Workers should be encouraged to become proficient in several skill areas; this makes assigning tasks more efficient. However, avoid trying to qualify everybody to do all jobs, that's expensive.

The data taken during characterization and follow-up surveys is some of the most important information which the project must control, for this is the evidence that the clean-up goals have been met. Instrument calibration must therefore be accomplished using the right standards for the isotopes which will be examined for. Release of materials or building areas requires a clear set of release criteria matched to existing standards. Also required is a detailed knowledge of how those release standards will be evaluated. There's no sense in trying to hit a residual activity reduction target that can't be measured by available instrumentation. Release criteria must have a sound statistical basis, and must recognize the sensitivity and limitations of the instruments that will be used for

measurements.

Documented safety and health (including radiation protection) programs must be developed commensurate with the hazards expected. All workers need to be trained so as to understand their responsibilities for effective project performance as well as safe work practices.

DOCUMENTATION OF LESSONS LEARNED

One absolutely essential need for the effective performance of D&D projects in the future (and the future holds a lot of them) is the documentation and sharing of lessons learned. The lessons presented above, while they should not be astounding to anyone, show how it is easy to get into trouble if the basic rules of solid project management are not adhered to strictly.

REFERENCES

U.S. Department of Energy, 1992, Radiological Control Manual, DOE/EH-0256T.

U.S. Department of Energy, 1993, "Project Performance Study", prepared for the Office of Environmental Restoration by Independent Project Analysis, Inc., Reston, VA.