

MEANINGFUL ENVIRONMENTAL RESTORATION PERFORMANCE MEASUREMENTS

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ABSTRACT

Traditional earned-value based cost/schedule performance measurements focus on a project's entire baseline work breakdown structure (WBS) for performance measurement reporting purposes. This reporting methodology has its roots in construction project management, and provides a general indication of overall project cost/schedule "health." But, environmental restoration (ER) projects are different – instead of constructing (in the conventional sense), they are often more about "deconstructing," and a substantial portion of the total project baseline may be support, administrative, and indirect activities. While it is necessary to closely monitor the overall cost/schedule performance of an ER project, providing a heightened cost/schedule performance measurement awareness on a few key indicators, or "metrics," makes performance reporting more closely aligned with actual progress toward completion of the project's goals.

INTRODUCTION

Environmental restoration (ER) projects may have a large portion (in terms of schedule activities and cost) of the overall baseline committed to level-of-effort (indirect, support, administrative, and project management) activities. These activities proceed as a function of time, not progress, and including them in the overall performance measurement baseline may skew reporting and mask potential problem areas until it is too late to affect meaningful mitigation measures.

Providing special cost/schedule performance measurement reports that focus on a critical few cleanup activities (metrics) not only provides earlier indications of possible cost/schedule issues where it really counts – on the critical path - but it prevents earned-value claimed for level-of-effort work from skewing overall project progress. One of the prime reasons for adopting metrics is to help managers decide where they should allocate their resources.¹ An added benefit of the metrics-based approach is its low implementation cost: all of the data required is likely already being collected. What remains is to identify and quantify the new metrics, re-sort information and format new reports, all the while indoctrinating the management team on the new reporting methodologies and how they can be effectively utilized.

This paper examines the implementation progress and pitfalls of this reporting methodology as it is being implemented by Kaiser-Hill Company, L.L.C. on the Rocky Flats Closure Project at the U.S. Department of Energy's Rocky Flats Environmental Technology Site near Denver, Colorado. Actual project performance data from the Rocky Flats Closure Project has been used, comparing traditional total-baseline cost/schedule report results to metrics-based performance reports. Recommendations based on lessons-learned are provided on how to select meaningful

metrics and the minor modifications required to existing cost/schedule performance measurement systems to take advantage of this methodology.

METRICS v. TOTAL PROJECT REPORTING

“Metrics” are defined as those key accomplishments that most directly define the completion of the project. For example, if the purpose of the project is to decommission and demolish a facility, then the metrics would consist of the estimated quantities of materials removed from the facility and the quantity of construction rubble produced as a result of its demolition. Even though many significant pre-decommissioning activities may have occurred, it is the final demolition that provides measurable and visible evidence of project completion.

In our example ER project, the work breakdown structure (WBS) at level 2 or 3 may look something like this:

Table 1 Example Project Work Breakdown Structure (WBS)	
Element	Description
x.1	Site Screening, Sampling, Analysis, and Characterization
x.2	Modeling, Risk Assessment, and Identification of Alternatives
x.3	Alternatives Screening and Conceptual Design
x.4	Title I Design, Pre-Procurement, and NEPA Documentation
x.5	Title II Design, Construction Management, and Adv. Procurement
x.6	Mobilization, Construction of Temporary Facilities
x.7	Shutdown, Decontamination, Strip-out, & Dismantling
x.8	Demolition, Disposal, Re-vegetation
x.9	Project Management

To a project manager, client, or other stakeholder focused on the final results of demolition and site restoration, this WBS may seem over-complex and misdirected. The key activities – or metrics – associated with dismantling/decommissioning, demolition, transportation and disposal of hazardous materials off site, and re-grading/re-vegetating the site, are barely evident at the WBS level shown.

Although the metrics represent the activities that ultimately accomplish the ER, their overall cost and appearance on the schedule critical path may be nominal, especially during early project stages. Their contributions to the end-objective, importance in satisfying regulatory milestones, and relevance to earning fee are significant, however.

To set up a metrics-based reporting scheme the project team must identify the metrics (which we have previously defined as our key accomplishments leading to project completion), list the WBS elements/schedule activities that complete them, and then program new cost/schedule performance reports based on these WBS elements/schedule activities. If this seems basic and simple, that’s because it is.

Selection and quantification of metrics should be a collaborative effort between integrating contractor, major subcontractors, the client, and the stakeholders/regulators. “Selection” is the process of identifying the metrics and selecting the appropriate WBS elements/schedule activities. “Quantification” refers to making a determination of the units of measure (tons, cubic meters, etc.) applicable to the metric and determining the total quantity for the project. Once defined, agreed upon, and approved, metrics may be incorporated directly into the incentive fee clauses of affected contractors/subcontractors. Formal change control procedures should be applied to project metrics to avoid unexpected scope growth, ensure thorough and accurate analysis of pending changes, and to keep performance contracts in line with the project’s mission and requirements. The management team – including the client – must understand and agree upon the methodology to be used when metric quantities change, and how such changes will affect the earned-value reporting baseline.

The success of metrics-based reporting is largely dependent upon the ability of the project controls system to handle the appropriate earned-value (EV) methodology(-ies). This means that the EV types permitted by the system must relate to the metric unit of measure, budgeted cost of work scheduled (BCWS) must be appropriately time-phased to match the operations or production schedule, and the recording of budgeted cost of work performed (BCWP) must be relevant and timely. Actual costs, of course, must be captured and reported in the same period as performance.

When performing work planning and making EV determinations, simple level-of-effort EV should be avoided altogether for activities related to metrics. In identifying the activities to be included in the metrics performance report, every effort should be made to eliminate other level-of-effort tasks that might mask or skew performance reporting.

For the Rocky Flats Closure Project, out of a choice of several thousands of activities, the following 15 metrics were chosen as the key indicators of progress toward Site closure:

- 1) Special Nuclear Material (SNM) Shipments (percent of total quantity),
- 2) Shipment of Pu Metals & Oxides (kilograms),
- 3) Draining of Building 371 Areas (liters),
- 4) Draining/Removal of Building 771 Liquids and Systems (liters),
- 5) Treatment/Stabilization of SNM Residues (kilograms.),
- 6) Shipment of Low-Level Mixed Waste (LLMW) for Disposal (cubic meters),
- 7) Shipment of Low-Level Waste (LLW) for Disposal (cubic meters),
- 8) Shipment of Transuranic Waste (TRU) for Disposal (cubic meters),
- 9) Disposal/Recycling of Non-Radioactive Waste (cubic meters),
- 10) Shipment of Sanitary Waste for Disposal (cubic meters),
- 11) Disposition of Waste Chemicals (quantity of units),
- 12) Demolition of Buildings and Facilities (quantity of buildings),
- 13) Remediation of Environmental Sites (quantity of sites),
- 14) Disposition of Property (quantity of items), and
- 15) Disposition of Classified Matter (quantity of items).

For fiscal year (FY) 1999, the activities associated with these metrics account for only around twenty (20) percent of the total budgeted cost of work scheduled (BCWS), but will accomplish all of the regulatory milestones and earn site contractors the majority of their incentive fee. Using the metric/project ratio of 1:5 it can be readily visualized how reporting at the total project level could easily mask emerging performance problems for the key metrics.

Figure 1 presents Rocky Flats Closure Project cost/schedule performance data for October 1998 (FY99). Taken at the total project level, the cost/schedule variances (fiscal year to date) were 8.5% and **-6.8%** respectively – not outside the variance range, for most projects, where formal written variance analysis and mitigation plans would be required. Looking exclusively at the key metrics, however, the cost variance has increased to 11.5% and the schedule variance to **-13.9%** -- values that would require formal written variance analysis and corrective action plans on almost any project. The capability of metrics-based reporting to bring immediate focus onto key activities is the reason that this methodology has been adopted as the “level 1” reporting format for the senior management team on the Rocky Flats Closure Project. Based on one month’s FY99 reporting data, corrective actions are already underway at Rocky Flats to ensure problem root causes are identified and issues corrected.

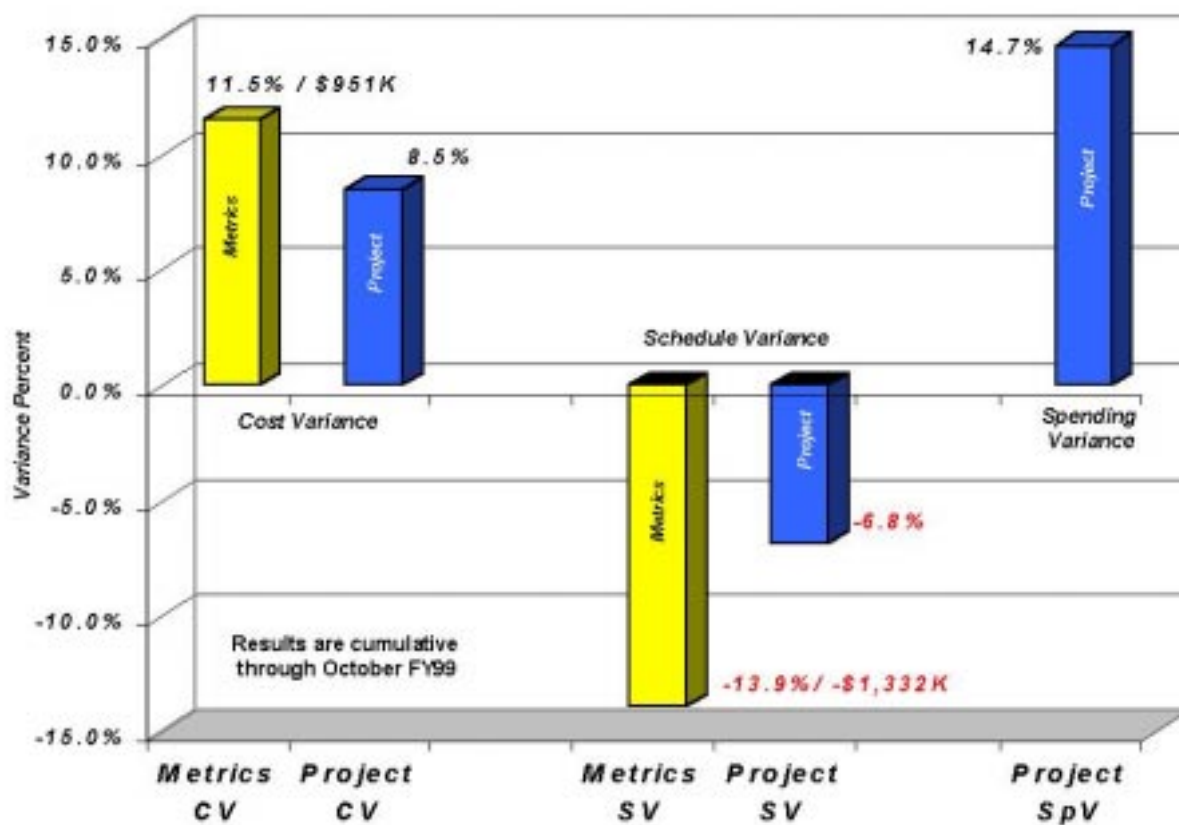


Figure 1 - Cleanup Metrics v. Total Project Performance

DRILLING IN ON KEY METRICS

Once the work breakdown structure elements comprising the completion of each metric have been identified and established in the reporting system, an additional detail level of cost/schedule performance reporting can be established for each individual metric, as shown in Figure 2. Individual metric reporting is a continuation of the same rationale that led to project-level metric reporting, continued down to the next level in our WBS/reporting structure. Once individual metric reporting is established, information can be sorted by area, organization, or any other sub-tier reporting structure required by the management team.

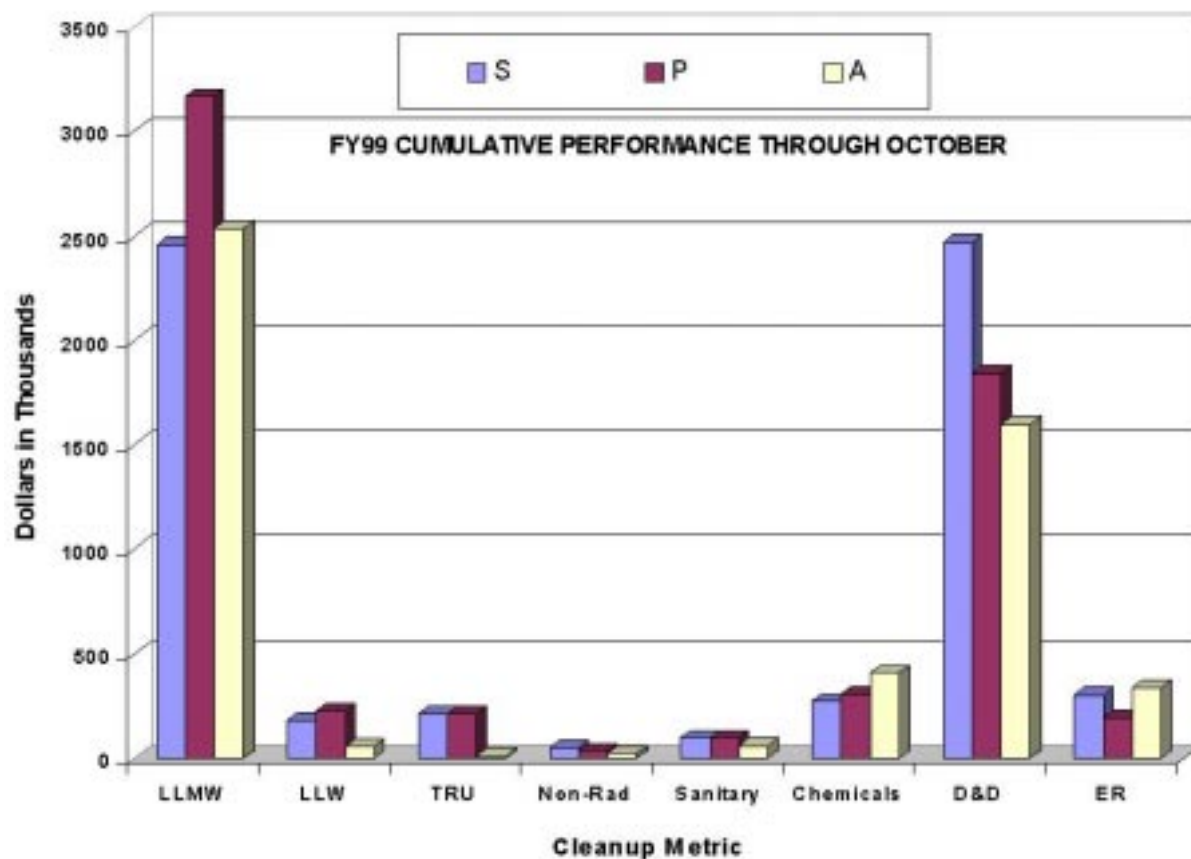


Figure 2 – Tracking Performance For Individual Cleanup Metrics

One significant benefit from establishing metric reporting derived from the project WBS and schedule, is that the data downloaded to produce reports is taken from the same database used for the balance of project reporting. No manual re-entry or “adjustment” to data is required – thus accuracy and reliability of the information is as good as that of the overall database.

CONCLUSIONS AND RECOMMENDATIONS

Efficient management of project risk and mitigation of adverse trends is highly dependent upon the involvement and commitment of the senior management team. Since the senior management team has only limited time available to review and analyze monthly reporting data, any technique that maximizes the use of this time has the potential to produce a tremendous benefit to the project. Metrics reporting is a technique that accomplishes this goal, by focusing on the key activities, events, quantities, or milestones most closely tied to a successful (and profitable) project completion. The use of metrics enables us to “drill-down” to specific items of interest, providing new focus and direction to our earned-value reporting system. It is also possible – and desirable – to change, add, or delete certain metrics as a project progresses, ensuring the attention of senior management is properly directed to maximize their efficiency.

Relational database technology now provides us with the capability to identify and report cost/schedule performance on any single or combination of auxiliary data field or elements of our project. This provides us with the opportunity to create multiple and diverse “metrics-type” cost/schedule performance reports specifically tailored to the needs of the senior management team.

It is not only possible, but reasonably simple, to establish metrics reporting for an ongoing ER project. Deciding on the individual metrics and properly cross-walking the WBS are the most difficult tasks. The use of this technique on an existing project is limited to the information content dictated by the project WBS and the reporting structure created at project startup. Adding new sorting or filtering elements may require extensive database modification. For new project starts, early identification of key metrics makes it possible to ensure the WBS and reporting structures thoroughly incorporate all desired reporting requirements. When identified prior to project start up, an unlimited (except by system capability) suite of metrics and cross-tabular reporting is possible.

¹ Meyers, Randy, Measure for Measure, CFO Magazine, November 1997.