Environmental Cost Analysis System (ECAS) Status and Compliance Requirements for EM Consolidated Business Center Contracts – 13204

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ABSTRACT

The Department of Energy (DOE) Office of Environmental Management (EM) has developed a web-accessible database to collect actual cost data from completed EM projects to support cost estimating and analysis. This Environmental Cost Analysis System (ECAS) database was initially deployed in early 2009 containing the cost and parametric data from 77 decommissioning, restoration, and waste management projects completed under the Rocky Flats Closure Project. In subsequent years we have added many more projects to ECAS and now have a total of 280 projects from 8 major DOE sites. This data is now accessible to DOE users through a web-based reporting tool that allows users to tailor report outputs to meet their specific needs. We are using it as a principal resource supporting the EM Consolidated Business Center (EMCBC) and the EM Applied Cost Engineering (ACE) team cost estimating and analysis efforts across the country. The database has received Government Accountability Office review as supporting its recommended improvements in DOE's cost estimating process, as well as review from the DOE Office of Acquisition & Project Management (APM). Moving forward, the EMCBC has developed a Special Contract Requirement clause or "H-Clause" to be included in all current and future EMCBC procurements identifying the process that contractors will follow to provide DOE their historical project data in a format compatible with ECAS. Changes to DOE O 413.3B implementation are also in progress to capture historical costs as part of the Critical Decision project closeout process.

INTRODUCTION

ECAS is an outcome of the Department of Energy's (DOE's) effort to collect actual DOE-Environmental Management (EM) cost data to capture historical costs for its various cleanup projects. Capturing these costs supports EM's cost estimating capability with data on what was actually required to accomplish cleanup work. It originated from an effort in the mid-2000s by the then Office of Project Management Oversight, EM-53. Part of this effort was to support the development of a framework to allow comparison of like types of cleanup work (which resulted in the Environmental Cost Element Structure [ECES], a "code of accounts" for environmental work). Other efforts collected costs from a number of small EM projects, but the data was collected and stored in a fashion which made it difficult to retrieve information without having extensive knowledge concerning the data stored. EM-53, recognizing the Rocky Flats Closure Project (RFCP) and its $4.1 billion of cleanup work, was nearing completion, began an effort in 2005 and 2006 to capture that project's environmental management data – i.e., decontamination and decommissioning (D&D), environmental restoration (ER), and waste management (WM) – from actual project costs, parametric databases, and documents. During this effort the closure project cost data, the waste generation and processing data, and the non-cost parametric data (e.g., areas of buildings, cubic feet of soil removed) were collected and assembled. Also, considerable effort was made to assess the value of data (e.g., was it cost-driving or of general interest), how would it be used, which data could be addressed quantitatively (e.g., cost, waste volume) and which qualitatively (e.g., contamination levels, contaminant types). The final result was Excel spreadsheets containing all of the data; however, the data was not in an "accessible" format – a user would have to understand a great deal about the RFCP before they could

confidently use the data, or even find what data they wanted using the closure project work breakdown structure.

Coincident with this effort by EM-53, the Government Accountability Office (GAO) was investigating DOE's approach to managing projects. In 2007 [1] and 2008 [2] they identified areas in project management, including in the cost estimating of large projects, which required improvement. In late 2007, DOE initiated a root cause analysis effort to address GAO's findings, in part in an effort to be removed from GAO's list of agencies at high risk for fraud, waste, abuse, and mismanagement. In mid-2008, DOE adopted a corrective action plan (Contract and Project Management: Corrective Action Plan, July 2008) designed to mitigate the issues identified in the root cause analysis. The plan identified insufficient independent cost estimating capability as one of the top five reasons why DOE was unable to complete projects on cost and schedule. Specifically, Corrective Measure 5 required ensuring adequate independent government cost estimates by establishing an independent government cost estimating capability, with part of that capability being developing a historical cost database. The associated plan of action was to develop an initial cost estimating database by June 1, 2009.

Starting at the end of FY2008 the Office of Cost Estimating and Analysis at EM's Consolidated Business Center (now the Office of Cost Estimating and Project Management Support [CE&PMS at the EMCBC]) picked up the ECAS effort as part of EM's response to Corrective Measure 5. The initial effort included developing a structure for the data that would make the data accessible, imposing that structure on the Rocky Flats data, and placing that data in a web-accessible database that could be used by CE&PMS staff for their work. Additional work collected data from the Melton Valley project at Oak Ridge. The database containing the data from these two projects was up and running on a test platform with initial reporting capabilities by the middle of FY2009.

In 2009 the GAO again evaluated DOE's approach to developing cost estimates [3]. The GAO recognized the ECAS database as "containing historical actual costs from two of EM's cleanup projects and helped to develop a standard way of organizing work scope within a project to ensure all cleanup projects collect actual costs in a way that is consistent with the new database." During 2012 the GAO again reviewed EM's approach for managing cleanup projects, focusing on American Recovery and Reinvestment Act (ARRA) projects. GAO members spent time at the EMCBC evaluating the ECAS system as part of its evaluation of EM's overall cost estimating reliability. Although lack of historical cost collection had been a significant issue in previous reports it was not mentioned as a deficiency in the 2012 review [4], which was consistent with generally satisfactory on-site discussions about the ECAS database during the review.

At the 2010 Waste Management Conference we presented a paper [5] that discussed the ECAS system at that time, and included details on the data organization, content, and structure; the normalization approach to collect the data, the reporting arrangement at that time, and some examples of how the data might be used. Since that time there have been changes to the database as we have added data and projects, included additional features, and changed the reporting formats and reports. We also have expanded the organizations that have been using the data, and are in the process of putting the policies and procedures in place to collect data to populate the ECAS database from all major environmental projects.

The discussion of the ECAS system and future contract requirements is important both for potential users and for the contractors that will be required to submit information as part of their proposals. The ECAS database contains the most comprehensive set of actual DOE EM project data available to potential users to either evaluate overall project costs or develop cost estimating relationships for specific cleanup activities. More importantly, the Special Contract Requirement clause or "H-Clause" being inserted into current request for proposals (RFPs) will require additional scope associated with project baseline development and validation that will need to be addressed in proposal technical and cost volumes. Also, changes are in progress to make reporting of ECAS-compliant project data a requirement of the Critical

Decision (i.e., CD-4) process. Contractors must be aware of these requirements in developing proposals and executing cleanup work.

The remainder of the paper recaps some of the key features of the ECAS database including its content, structure, and normalization approach, and discusses the added content and features. Finally it discusses the actions that are in progress to include contractual requirements to collect ECAS data and to provide that data to EMCBC as part of the project closeout process.

DISCUSSION

Considerations in ECAS Data Organization

EM scope contains a wide range of project types that range from small isolated projects to highly integrated mega-projects. The available cost data and secondary project parameters vary greatly in detail and structure. We have designed ECAS to have the flexibility to accommodate this disparate data and provide the analytical structure to organize it consistently. ECAS includes actual cost data from accounting databases, secondary project "parameter" data (e.g., independent non-cost variables that drive costs), and descriptive information providing qualitative information on cleanup activities. The data has been collected and arranged (i.e., "normalized") to allow a user to access it at various levels of aggregation, but without needing an intimate understanding of the underlying site Work Breakdown Structure (WBS) from which the data was derived. This is accomplished by organizing the cost and parameter data using the ECES codes and "ECAS Projects." The result provides an adjustable level of detail that allows an ECAS user to create cost factors, cost estimating relationships, and models tailored to the specific project to be estimated or analyzed. Thus the ECAS database is not a cost estimating program; it provides historical data an experienced estimator can use in developing relationships to address a wide variety of topics.

A key feature in data accessibility has been organization of the data by "ECAS Project." EM scope covers extensive, site-wide environmental actions that completely clean up large industrial complexes. Each site is complex with its own unique physical and organizational features. There will never be another project exactly like the Rocky Flats, Mound or Fernald site closures, and overall data at the site level does not provide sufficient resolution (i.e., dividing the $4.1B Rocky Flats Closure Project (RFCP) cost by 3.5M ft^2 [SF] does not really provide useful D&D information). All lower-level site cost and parameter data for EM site work is organized by site-specific WBSs. Without some kind of "project" organizational structure (in addition to the detailed types of work categorized in the ECES), developing accurate data for future analyses or estimates required intimate knowledge of how the site had organized its work. There was a need for a user to be able to intuitively identify scope within ECAS that was similar to the work that he was estimating or analyzing. Our approach was to define "ECAS Projects" during the normalization process within the actual site data that could be comparable across the EM scope and independent of individual WBSs.

The ultimate usefulness of ECAS depends on the data it contains. Determining what data to include and how to organize it so that it would be useful was an effort that required several iterations, various compromises, and input from numerous contributors. We identified two major tradeoffs inherent in processing of data into a more accessible condition (e.g., cost factors or other relationships). More analyst effort is required to take the data to a more accessible state, but correspondingly less user effort is required to apply it to an estimate. Also, as data becomes more processed it may lose potentially relevant information, such as size of project, contaminant types, and data variability among projects. We made a conscious decision in our normalization approach to process the data sufficiently for a user to access a wide variety of information, but not need to become intimately familiar with the sites from which the data was derived, to develop credible cost analyses. The corollary was that developing data for analyses

would require substantially more experience and effort on the user's part than if the data was available in cost factor format.

Initial Database Content and Structure

ECAS is organized in a standard format based on several key elements:

- Separation of "direct" scope – i.e., that scope that can be can be associated with parametric data (e.g., area decontamination costs are a function of area SF) – from "indirect" scope that is less directly associated with parameters e.g., site finance and accounting. The indirect scope is collected and distributed across direct cost elements as identifiable add-ons at project, program, and site levels (and also for waste costs, if not direct project charges), so that a "direct" costs and the "overhead" costs can be differentiated.
- Organization of the direct scope into "ECAS Projects." For example, the D&D of a significant contaminated building (involving planning, equipment removal, decontamination, and demolition activities) might be one project, excavation of a number of collocated VOC releases sites might be a second, and the removal a group of trailers and small office buildings might be a third.
- Use of the ECES as a code of accounts (ASTM E2150-02, similar to the Construction Specifications Institute [CSI] accounts used for construction) to identify the type of work in a consistent manner. For instance many D&D projects would have project management, characterization, deactivation, and waste management costs among a variety of other types of work; these would be differentiated by ECES code while the overall scope would be contained within the ECAS Project.

The remaining fields associated with direct scope elements provide either non-cost parameter values or descriptive information. The non-cost parameters include waste volumes (by waste type), relevant principal metrics (e.g., gross square feet for decommissioning), and secondary parameters to provide additional cost driver information (e.g., glovebox volume). These allow a user significant additional analysis options (e.g., projection of waste volumes and categories from cost or non-waste parametric data). The descriptive information allows a user to judge the work type, scope, complexity, radiological considerations, and similar qualitative properties. Additional information is available in our earlier paper [5] and in the ECAS User's Manual on our web site.

In grouping scope into ECAS Projects we tried to optimize the number of projects to preserve fundamental project distinctions but avoid a proliferation of types that would result in groups with only a few projects each. Too few ECAS Project Types would result in dissimilar projects being binned together (e.g., research reactors and commercial power reactors under "Reactors"); too many Types would make it difficult for a user to screen potential projects. We also had to limit the descriptive information to a relatively small set of "descriptors" to allow for sorting; this resulted in a loss of some detail in the information (e.g., we could note RCRA-organics or PCBs but not both). To remedy this we have developed a "Project Narrative" document for each ECAS Project so that the project-specific information is retained in more detail. Thus, if a user wanted detailed information on the one ECAS Project closest in scope to one he was estimating, he could screen the universe of ECAS Projects to the two or three closest using database data, and then review Project Narratives from each of those projects to choose the one most representative.

ECAS Normalization Process

The cost and parameter data in their raw form need considerable processing before they can be inputted into the ECAS database. For large projects, the cost data from accounting databases typically contain hundreds of thousands of records. Each source record identifies cost as well as information such as hours/worker/pay period, invoice payments (and accruals and reversals), and similar data all containing relevant data such as WBS, charge numbers, accounting codes, descriptions of the work charged or item

purchased, organization codes, etc. The waste data is often derived from waste data management systems tracking each container managed. Other parameter and descriptive data is available in different forms, such as cost estimates, baseline scope, and regulatory and closeout documents.

The process of reducing this data into information suitable for ECAS begins with data analysis, an iterative effort where site data is collected, analyzed, gaps identified, and efforts made to collect data to fill the gaps. A second concurrent activity is to define the ECAS Projects, necessary at this stage to focus the data collection. Draft ECAS Project Narratives are developed as a way to collect parametric (as opposed to cost) data on projects and provide a traceable reference for such data.

In parallel, ECES codes and ECAS Project names are assigned to cost data, usually at the charge number level. This effort is also iterative in that as more information is developed the charge numbers might be reassigned to different ECAS Projects or assigned to a different ECES classification. Microsoft Excel© pivot tables and/or Microsoft Access© queries are used to summarize data – all costs for charge numbers sharing a single ECES code and ECAS Project descriptor are grouped together.

When a cost table exists we insert scope values – i.e., waste and non-waste parameters – into the table based on the ECAS Project. The parameters are identified as "primary" parameters restricted to specific units of measure for different project types (e.g., SF for all D&D projects) and "secondary" cost-driving parameters that would provide additional information but would not always be required (e.g., glovebox or process tank volume). Defining and identifying the appropriate cost-driving parameters is a significant effort and sometimes results in reorganization of ECAS projects.

Once an initial input table has been completed there are numerous reviews and validations. Direct costs are used to develop "indirect" costs to identify the "overhead" that DOE must pay to achieve the ECAS Project scope. These indirect costs include site management, finance and accounting, security, utilities, waste disposal, essential site services and similar costs – costs for which the cost-driving independent variable is direct cost, not a non-cost parameter. The final step is incorporation of the data from the "input table" into the ECAS database proper, a step that confirms that the data is in the correct format.

Current ECAS Content – Projects Added to the ECAS Database

Since 2009, we have significantly increased the numbers and types of projects contained in the database from the beginning Rocky Flats data. We initially included cleanup activities from the Melton Valley work, and the Mound and Fernald closure sites. The largest effort has been to include over 125 EM ARRA projects from Oak Ridge, Idaho, Savannah River, Nevada, and Hanford. These projects have included decommissioning of hot cells, reactors, diffusion plants, tanks, and other facilities; various groundwater treatment and remediation of a variety of waste sites; and capital and operating activities to manage a variety of waste types. When all these ARRA projects are added to the database, ECAS will contain information on 280 projects from 8 major DOE sites. An overview of the projects by scope is given in Attachment 1.

As we added the ARRA scope to ECAS Projects to the database we needed to resolve the following issues:

- The ARRA scope was not complete for all of the potential ARRA projects – as we began the work in 2010 a number of the ARRA projects at Oak Ridge, which was our first site, were not complete. We resolved this by including only those projects where all field work had been completed and were greater than 98% complete (essentially in the closeout phase). This required eliminating or postponing 18 out of 32 potential projects (probably nearly 50% of the total Oak Ridge EM ARRA scope) due to the status of the projects. This problem became smaller as we progressed through the sites.

- Communication with site organizations – Our approach for the ARRA scope was go to the site, provide a presentation to site project control and ARRA management staff (both DOE and contractor), collect initial data and have more targeted meetings with specific site staff, receive initial additional data, create draft "templates" with identified data gaps, create targeted questions to address those data gaps, and work with site personnel to close those gaps. We took this approach to minimize the site personnel effort; they did not have to understand the ECAS system, we had to learn enough about the ARRA scope to be able to create the necessary ECAS input data structures.
- Limitations on ECAS Project scope – Most "projects" are only a piece of a larger effort. For example, rarely does a large, multi-year D&D project include all post-operation activities – defueling/run-to-empty, deactivation, removal of interior equipment, decontamination, demolition, removal of subsurface structures; or an ER project include all activities from initial surveys through Remedial Investigations/Feasibility Studies through excavation and regulatory closure. These efforts may span decades and often several site contractors. For ARRA projects whose duration was limited to just a few years the problem was worse, and so the more significant projects tended to be subdivided – one "decommissioning" project might be just deactivation while another might be just demolition, depending on what activities were "shovel-ready". This placed additional effort on the historical data collection to make these differences in scope transparent and required additional detail in our Project Narratives.

Additional ECAS Features

We have added several additional features to the ECAS data:

- Project Narratives – we recognized even as the initial database was being created that there was information on ECAS Projects that was not "quantifiable." Over the next several months we created a short Project Narrative format to organize qualitative project data into a standard format. Starting with the ARRA ECAS Projects we are creating Project Narratives concurrently with the development of the template data. These Project Narratives include information on (1) initial conditions – e.g., type of building or release site, past history of processes or releases, types and extent of contamination, etc.; (2) specific issues associated with the project – specific elements of scope addressed (e.g., deactivation but not demolition); issues with management, regulation, and physical/technical approach (e.g., decontamination and clean demolition versus contaminated demolition); and (3) limitations on use of data. We have now completed the Project Narratives for almost all ECAS Projects included in the database.
- Project Descriptions – We identified a problem with the project names included in the ECAS database not being sufficiently descriptive of the project scope. This was resolved by creating a limited "Project Description" for each ECAS Project that provides several sentences describing the project. This allows a user to evaluate the different projects in a given category (e.g., RCRA C Caps) to quickly determine which project is closest to that of the scope he is estimating. The user may then decide to further investigate one or more ECAS Projects by looking at the appropriate Project Narrative, a task that might be burdensome for a larger number of potential projects.
- Escalation for costs – ECAS provides both un-escalated and escalated costs for particular work elements based on standard DOE escalation tables and the ECAS Project completion date.

Current ECAS Report Features

ECAS features a web-accessible database reporting tool allowing users to generate several report types and export the results as CSV files into Excel for additional analysis. The ECAS SQL Server database is located on EMCBC servers and the system is currently managed by EMCBC information technology staff.

The original ECAS database was created by Project Performance Corporation staff on a DOE server "test platform" at the Savannah River Site. The system was running and functional in 2009, and included a number of report types. In 2010 the decision was made to move the database to the EMCBC servers and place the responsibility for system maintenance with EMCBC staff. Hosting the database at EMCBC involved substantial configuration changes to reflect the different server environment and was a major effort in 2011. At the same time additional reporting features were added.

One of the major enhancements added to ECAS in FY11 was the establishment of "web based" access and the development of an improved report generation tool. Once users login, they are directed to the ECAS home page which includes the report tool. This tool is based on a series of standard queries to the ECAS database. These queries are designed to select and summarize data that serves the needs of baseline ECAS users. After selecting the report type users can further customize their report outputs through a series of drop down filters for site, project type, and a number of secondary parameters (waste type, building type/construction, remediation type, etc.). Advanced users needing more comprehensive information are given the option of running a query that can provide all the data in the ECAS database.

ECAS currently provides up to four report types with increasing complexity. These include: a Parametric Report, an Element of Cost Report, a Detailed Report, and an All Data Report. The Parametric and Element of Cost reports are run at the ECAS project level, while the other reports are run at the subproject level with activities identified by the ECES including project phase and major elements.

- Parametric Report – This report allows users to select various filters to develop a parametric comparison of stored projects. Parameters are based on major project type (D&D, Environmental Remediation (ER), Waste Management) and could include: D&D ($/SF); ER (type and $/gal, soils volume, etc.; WM (volume and type waste with a $/CF). An example filter could include selection of "All sites; Building/Facility D&D; Plutonium/Enriched Uranium type buildings." This yields a report containing 21 projects with D&D costs up to over $6,700.00/SF for a test reactor. This allows for a high level comparison of the unit cost that EM has experienced for D&D project for these types of facilities.
- Elements of Cost Report – This report will allow users to filter through the ECAS projects and generate a report with costs segregated by typical FAR Part 15, Table 15-2 Elements of Costs (Labor, Material, Equipment, Subcontract, etc.). This report is particularly useful for evaluating cost estimating relationships by the elements of costs.
- Detailed Report – The detailed report is also an element of cost report, however, it is run at the project and sub-project level. Data is presented by ECAS project and subdivided by ECES code and Cost Element. Users can evaluate a sub-activity for example: Project Management (ECES= 4.02) or Sitework (ECES = 4.05), and so on for the various project selected via the filtering tool. This report is also useful for evaluating the cost estimating relationships by element of costs at not only the project level but at sub project levels as well.
- All Data Report – The All Data report includes the detailed report, and also includes over 40 secondary "non-cost" factors that are stored in ECAS. Essentially this report allows users to access all the information in the ECAS data. The secondary parameters in the All Data Report can include things like: technical, regulatory or stakeholder complexity; geologic and soil conditions, waste type and media, etc. This allows advanced users to not only see the costs at the project and sub-project level but also evaluate the various factors that affected the costs. An export table of the All Data Report is provided in Attachment 2. The actual exported table has been reformatted to reflect the page limitations of this paper.

The reports can be reviewed on-line to identify how the data is presented and then exported as a CSV file into Microsoft Excel. A separate table provides the Project Descriptions for the individual projects and the User's Manual can be accessed on-line.

Recent Use of ECAS

Since its inception ECAS has been used by CE&MPS as a fundamental tool to benchmark their estimates of EM work in Independent Government Cost Estimates (IGCEs), project and site baseline analyses, and evaluation of budgets. While IGCEs are required to be developed using a bottoms-up approach, comparing the result with appropriate ECAS projects is a critical step in ensuring reasonableness for every appropriate IGCE.

Several specific additional analyses have been performed; additional examples were provided in our previous paper.

- A specific effort was made to cross-reference the execution cost for the K-33 project against the IGCE. The ECAS database allowed for more detail in the analysis than just comparing the overall project costs.
- ECAS was used as a secondary method for comparing the cost to disposition facilities currently operating at DOE sites that have yet to be transitioned to EM – essentially potential future EM liability against ECAS project types as a comparison to current site out-year budget forecasts.
- ECAS was used to develop costs for disposing of various waste types at a large site based on project types and waste volumes; this was important in ensuring estimates properly reflected the on-site disposal costs.
- ECAS was used to assist United Kingdom governmental efforts to estimate glovebox disposal costs.
- ECAS is currently being used to support Canadian effort to develop realistic budgets for the multi-billion dollar effort for Chalk River remediation.

Despite the level of data in ECAS, as currently configured it does not provide cost estimating relationships (CERs), i.e., straightforward relationships for detailed costs (labor costs and hours, materials, subcontract) to execute specific kinds of work. While overall factors are available for all projects (i.e., $/SF for D&D), the level of detail does not sufficiently differentiate between cost drivers as compared to a credible (and time-consuming) bottoms-up estimate.

For instance, the costs of removing equipment in plutonium facilities (e.g., collectively gloveboxes, piping, tanks, and general room equipment) are well represented, with the costs and parameters representing equipment removed available for a total of six projects at both Rocky Flats and Hanford. However, the charge number (and hence ECAS data) did not differentiate between equipment (i.e., workers removed gloveboxes, tanks, and pipe under the change number for work in separate sets of rooms). So while the data is there, additional analysis is necessary to create the CERs, something that requires more user time and sophistication than is typically available.

We have developed two initial CERs using ECAS. The first was based on an analysis of direct vs. non-direct construction costs for DOE projects that is being used by DOE-HQ in their project budget analysis. The second is the development of a cost model to support the estimate of excavation of variously-contaminated soil for use by the Navy in their remediation efforts, in which ECAS data was used to support best-fit model costs across numerous projects.

Future Compilation of Historical Data into ECAS

ECAS has demonstrated its success as a historical cost database, but inputting data into it has been an ad-hoc process. Due to the various ways that sites and EM have executed contracts it was not possible to collect historical costs for all EM projects, especially considering that projects have been executed over decades through multiple contracts. The current effort has resulted in a 280-project database with an

aggregate value in excess of $10-billion, but by no means includes all EM projects. The ECAS team is addressing collection of ECAS data along two fronts. These entail (1) incorporating ECAS reporting requirements into EM contracts, and (2) as an integral part of the Capital Project completion requirements required under DOE O 413.3B. This ability to support the ECAS data collection process will become a factor in a company's ability to win and receive fee for EM work.

DOE Order 413.3B, Program and Project Management for the Acquisition of Capital Assets prescribes the process DOE uses to manage projects, with Critical Decisions (CD-0 through CD-4) as program milestones for approving mission need, project definition, performance baseline, start of construction, and project completion. CD-4, Approve Start of Operations or Project Completion currently includes requirements for a Final Project Closeout Report. However, it is recognized that the prerequisites for environmental project completion require starting long before actual physical completion to ensure orderly transition. This is also true for developing project historical data, since a lesson learned from collecting data from closure sites is that technical and management staff is often long gone during the financial closeout phases.

Therefore, the EM-11 Office of Environmental Management Standard Operating Procedure, Validation of Project Readiness for Approval for Operations Critical Decision-4" effective 9/30/2011, No. EM-11 SOP004, Rev 2 document is being changed. It will include language requiring EM projects to provide historical project data in an ECAS-compatible format.

In addition to including the development of historical cost and parametric data? in the EM-11 SOP004 requirements, the EMCBC is including standard language in the special contract requirements section (Section H) of request for proposal documents for future cleanup projects to require collection of historical cost and parametric data during project execution. The new contractual reporting requirements to support the ECAS are designed to initially ensure that the scope of the cleanup effort is cross-referenced to the ASTM standard and standard cost elements and appropriate waste and other project parameters are specifically identified. Demonstration that ECAS data can be adequately reported will be part of baseline approval (the CD-2 milestone), and properly normalized ECAS reports will be required for project closeout approval.

The "H-Clause" will contain general information on ECAS data structure, ECES coding, and ECAS organization of cost elements (e.g., labor, material, subcontracts, etc.). It also generally describes the approach to collect and distribute non-direct charges (i.e., site and program management, G&A) and identify and collect non-cost parameters. It is anticipated that the definition of ECAS projects will be identified as part of the baseline development process. Thus the "H-Clause" is the mechanism to add requirements to contracts; modifying the CD-4 requirements will require the projects to provide ECAS data for successful completion.

Next Steps

In addition to implementing the process to include the collection of ECAS data into the project and contracts management processes there are three areas that we are considering for ECAS improvements: adding additional project data, continuing to improve the reporting functions, and developing approaches to support the creation of cost estimating relationships. Also, the ECAS database was designed at its inception to be both a reporting and transactional database. Development of a data entry front-end is a possible future enhancement. Currently data is migrated from Excel spreadsheets to the database using specialized data migration scripts.

The ECAS database is used often for checking reasonableness of costs for specific work – at the highest level (e.g., the cost per building square foot for the demolition of a uranium-contaminated facility). It

works well in that it now contains many projects in most of the identified project types, although some particular types, such as those dealing with high-radiation decommissioning, are not well represented. We are evaluating potential additional projects that might be added to the ECAS database that might address these under-represented areas.

As discussed above we anticipate developing additional CERs based on ECAS data. This effort is both a function of user needs (CERs are probably uneconomical for one-off tasks) and an increased number of ECAS projects – i.e., it becomes easier as more data is available for curve fitting, data regression, etc.

Reporting is a user-driven function. Since ECAS contains such a broad range of data, identifying what data is available and how it may best be used to support a specific activity may be difficult for the occasional user in spite of the User's Manual and other resources. While the use of summary-level data (i.e., $/SF for a particular type of D&D) are common and supported by the current reporting structure, additional reports that provide specific lower-level parameters await user request.

CONCLUSION

ECAS has proven itself as a tool to support the EC&PMS mission to improve EM cost estimating, fulfilled the requirements of its corrective action plan as applied to EM's historical database, and has been observed by the GAO in their recent evaluation of EM's performance in this area. Plans are in place to add additional projects to the database and we are considering additional areas for reporting enhancement.

For additional information on topics in this paper, contact P.C. Sanford at sanfordp@hotmail.com. Access to the ECAS database itself is restricted to those authorized by CE&PMS.

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ATTACHMENT 1 – SYNOPSIS OF ECAS PROJECTS

Rocky Flats – A closure project completing the cleanup of DOE's Rocky Flats site that was subdivided into 77 ECAS Projects, including:

- D&D of five large plutonium processing facilities, several enriched and depleted uranium processing facilities, several moderately-contaminated facilities, and offices, other industrial building, and equipment for a total of 26 ECAS Projects (most involving multiple buildings).
- ER, including excavation of soil contamination in both dispersed and concentrated waste sites, small waste trenches, and old burial grounds for radionuclides and RCRA-hazardous materials, RCRA-C and Subtitle-D Covers, and a pump and treat facility for a total of 35 ECAS Projects.
- WM of both previously-generated (i.e., legacy) and newly-generated transuranic, low-level radioactive, mixed RCRA-radioactive, RCRA-hazardous, and sanitary waste/construction debris. Also included activities to prepare plutonium residues for disposal at the Waste Isolation Pilot Plant (WIPP), preparation and packaging of special nuclear material for transport and disposition, and the operation of a plutonium chemistry laboratory for a total of 16 ECAS Projects.

Melton Valley – An integrated program to close out most of the Oak Ridge facility in the Melton Valley watershed that was subdivided into 13 ECAS Projects, including:

- One D&D project involving the removal of a facility for ground-injection of high-rad waste.
- ER, including capping of larger near-surface radioactive waste landfills and excavation of various buried and injected wastes for a total of 9 ECAS Projects.
- WM of several previously generated waste streams, including high-level waste from a small nuclear reactor and various stored transuranic and low-level wastes within 3 ECAS Projects.

Mound – A closure project completing the cleanup of DOE's Mound site that was subdivided into 27 ECAS projects, including:

- D&D of numerous facilities ranging from completion of a Pu^{238} thermo-generator manufacturing building and a tritium component fabrication facility to waste treatment and industrial facilities, including 13 ECAS Projects.
- ER, including cleanup of several burial/release sites by excavation, for a total of 9 ECAS Projects.
- WM of both previously-generated (i.e., legacy) and newly-generated transuranic, low-level radioactive, mixed RCRA-radioactive, RCRA-hazardous, and sanitary waste/construction debris.

Fernald – A closure project completing the cleanup of DOE's Fernald site that was subdivided into 35 ECAS projects, including:

- D&D of numerous uranium refining and production facilities, laboratory, administrative, and support structures for a total of 16 ECAS Projects.
- ER, including cleanup of buried waste sites, process waste disposal pits, site restoration, and the pump and treat operation for a major uranium plume for a total of 12 ECAS Projects.
- WM, including disposition of several legacy materials, operation of an on-site disposal cell, and the treatment/disposal of substantial silo-stored bulk uranium tailings for a total of 7 ECAS Projects.

The ARRA required the development of comprehensive scopes of work and the collection of these scopes into individual projects that could be tracked and reported. In early FY2011 we began our effort, collecting project data from the Oak Ridge, Savannah River, Nevada, Idaho, and Hanford sites.

Oak Ridge (including projects at Y-12, Oak Ridge National Laboratory, and the East Tennessee Technology Park) – operating and closure sites that were subdivided into 14 ECAS Projects including:

- D&D of a number of uranium, mercury, and asbestos contaminated facilities; demolition of a large, substantially decontaminated diffusion plant building, and cleanup of a mercury-contaminated sewer for a total of 8 ECAS Projects.
- ER, including capping of a near-surface burial ground, drilling of monitoring wells, and removal of a high-dose in-ground storage tank for a total of 3 ECAS Projects.
- WM, including expansion of a RCRA-C landfill, a Subtitle-D landfill, and size reduction of a contaminated debris pile for at total of 3 ECAS Projects.

Nevada (Nevada Nuclear Security Site) – An operating site with a continued mission, there were 8 projects from ARRA scope added to ECAS, including:

- D&D of different facilities used in either high-rad testing or support of underground nuclear tests resulting in 3 ECAS Projects.
- ER of three underground test craters, one set of craters from atmospheric tests, and one unexploded ordinance area for a total of 5 ECAS Projects.

Savannah River (including both Savannah River Nuclear Services and Savannah River Remediation) – operating and closure sites that were subdivided into 52 ECAS Projects, including:

- D&D, including entombment of two production and one test reactor, a few highly contaminated facilities, and a number of industrial facilities; also various activities associated with stabilization of high-level waste storage tanks for a total of 22 ECAS Projects.
- ER, including soil capping, excavation, groundwater treatment, and various other remediation efforts to remove radioactivity, tritium, heavy metals, and volatile organic compounds from environmental media for a total of 22 ECAS Projects.
- WM, including expansion of a RCRA-C landfill, closure of another, and various packaging and management of selected wastes for at total of 6 ECAS Projects.

Hanford (including Richland Operations and the Office of River Protection) – operating and closure sites that were subdivided into 50 ECAS Projects, including:

- D&D of different facilities and structures ranging from plutonium gloveboxes to uncontaminated debris as part of an area cleanup for a total of 34 ECAS Projects.
- ER, including soil capping, excavation, groundwater treatment, and various other remediation efforts to remove mostly radioactivity, heavy metals, and volatile organic compounds from environmental media, including large groundwater treatment facilities for a total of 14 ECAS Projects.
- WM, including treatment and disposal of legacy mixed waste, and retrieval from “soil storage” and characterization and repackaging of various legacy transuranic wastes for a total of 2 ECAS Projects.

Idaho – Only one project has currently been included from the Idaho Closure Project, an ER project for in-situ grouting.

ATTACHMENT 2 – All Data Report

The following tables provide the information included in ECAS as provided by the All Data Report, as shown for a small Hanford ARRA project. The first table identifies the ECAS Project and ECAS Project Type/Project Type Detail, and the data's relationship to the Site WBS.

WBS Data	
Project_Type_All	Building / Facility D&D Project Type
SITE_DESC	HANFORD
PARENT_PROJECT_NAME	RL-D&D-R (WBS 040)
WBS_LEVEL_1	EM
WBS_LEVEL_2	RL
WBS_LEVEL_3	RL-0040.R1.1
WBS_LEVEL_4	40.02
WBS_LEVEL_5	040.02.17
WBS_LEVEL_6	040.02.17.04
WBS_LEVEL_7	040.02.17.04.03
WBS_DESC	[S] FACILITIES - T PLANT ZONE PHASE I
PROJECT_NAME	RL-T-PLANT ZONE FACILITIES D&D-D&D-R
PROJECT_NAME_DESC	Richland Operations ARRA T-Plant Zone Facilities D&D [Demolition of 6 industrial facilities, including a major steam plant, totaling 58,630 ft^2]
PARAMETER_PROJECT_TYPE	Building / Facility Project Type
PROJECT_TYPE_DETAIL	COAL/OIL POWER/STEAM PLANT

Overall Project Data	
SUM_OR_CE	SUM
MANAGEMENT_COMPLEXITY	LOW
TECHNOLOGY_COMPLEXITY	LOW
REGULATORY_COMPLEXITY	LOW
PUBLIC_COMPLEXITY	LOW
PERSONAL_PROTECTION_EQUIP_LVL	D
BUILDING_TYPE	B_TYP_1
BUILDING_CONSTRUCTION_DESC	MULTIPLE STORY NO LEVELS (BELOW GRADE SURFACE) BGS
BUILDING_STRUCTURE_DESC	STEEL FRAMED, SIDING
UNIT_CODE	SF
PARAMETER_QUANTITY	58,630
CONTAMINANT_TYPE_DESC	MIXED_RAD_ASBESTOS
PARAMETER_PEDIGREE	HIGH
ER_TYPE	N/A (D&D Project, not ER Project)
ER_TYPE_DETAIL_DESC	N/A (D&D Project
ER_TYPE_COMPLEXITY	N/A (D&D Project
GROUNDWATER_COMPLEXITY	N/A (D&D Project
WATER_COMPLEXITY	N/A (D&D Project
SOIL_COMPLEXITY	N/A (D&D Project
ECOLOGICAL_COMPLEXITY	N/A (D&D Project
WETLANDS_COMPLEXITY	N/A (D&D Project
HISTORICAL_COMPLEXITY	N/A (D&D Project
MEDIA_STATE_DESC	N/A (D&D Project

The previous table identified general qualitative data that can be used to categorize the project – i.e., what types of contamination are associated with the project, what kind of media or construction materials, was the project difficult to manage, etc.

Cost Data								
ECES_LEVEL_1	_PH_4	_PH_4	_PH_4	_PH_4	_PH_4	_PH_4	_PH_4	_PH_4
ECES_LEVEL_2	02	02	02	02	05	08	31	32
ECES_LEVEL_3	01	03	06	14	01	07	17	01
ECES_DESC	PM/ SUPPT/ ADMIN	REG ACT	PROC AND WARE-HOUSING OF EQUIP AND MAT	PROJ S&H	MOB-BILI-ZATION	SOLID MATL/ WST SMPL ANAL	REMOVAL OF ENTIRE FACILITY	WST STRM MGMT
_START_DATE	1/1/10	1/1/10	1/1/10	1/1/11	1/1/10	1/1/11	1/1/10	1/1/11
_END_DATE	12/1/11	12/1/11	12/1/11	12/1/11	12/1/11	12/1/11	12/1/11	12/1/11
BUDGET	160,443	137,599	6,660	2,934	206,291	102,769	11,945,341	
ACTUAL_HR	56	1,020	84	33	-	-	77,969	-
ACTUAL	110,591	94,845	4,590	2,022	142,193	70,837	8,233,715	-
PROF_LABOR	53,665	85,540	3,711	1,514			1,024,772	
CRAFT_LABOR				508			3,158,289	
PROF_SERVICES	2,046	2,891	879				199,196	
CONST_SUBCON	30,871	6,389			63,591	70,837	1,795,614	
EQUIP_RENTAL	5,139						1,086,575	
MAT_SUPPLIES	15,273				78,602		865,708	
FUEL_UTILITIES								
DIRECT_TOTAL	110,591	94,845	4,590	2,022	142,193	70,837	8,233,715	-
PROFIT_O/H								
L5_INDIRECT								
L4_INDIRECT	40,244	34,514	1,670	736	51,744	25,778	2,996,248	
SITE_INDIRECT	(26,112)	1,971		141			133,541	
WST_INDIRECT								132,173
TOT_INDIRECT	14,132	36,485	1,670	877	51,744	25,778	3,129,789	132,173
GRAND_TOTAL	124,723	131,330	6,261	2,900	193,937	96,614	11,363,503	132,173
PROF_LAB_HR	49	1,020	67	25	-	-	14,105	-
CRAFT_LAB_HR	-	-	-	8	-	-	58,777	-
PROF_SERV_HR	7	-	17	-	-	-	1,850	-
CONST_SUB_HR	-	-	-	-	-	-	3,238	-
OTHER_DIRECT	3,598	25	-	-	-	-	103,560	-
PEDIGREE_DESC	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH

The above table identifies the ECAS Project costs by ECES Code (columns) and Cost Element (rows). Dates are provided to support escalation.

Waste Data								
ECES_LVL_1	_PH_5	_PH_5	_PH_5	_PH_5	_PH_5	_PH_5	_PH_5	_PH_5
ECES_LVL_2	32	32	32	32	32	32	33	33
ECES_LVL_3	01	01	01	11	11	11	04	04
ECES_DESC	WST STRM HAND-LING/ PACK	WST STRM HAND-LING/ PACK	WST STRM HAND-LING/ PACK	TRANS BY TRUCK	TRANS BY TRUCK	TRANS BY TRUCK	ON-SITE DOE DISPOSAL COSTS, AND FEES	ON-SITE DOE DISPOSAL COSTS, AND FEES
UNIT_CODE	CF	CF	CF	CF	CF	CF	CF	CF
PARAM QUANTITY	22.05	70,916	12,514	22.05	70,916	12,514	70,916	12,514.61
WASTE_TYPE CODE	HAZ	LLW_ CH	MX_ LLW _LDR	HAZ	LLW_C H	MX_ LLW_ LDR	LLW_CH	MX_ LLW_ LDR
PACKAGE_ TYPE_CODE	CONT-GEN	BULK	BULK	CONT-GEN	BULK	BULK	BULK	BULK
DISPOSAL_ TREAT CODE	TRT_ AT_ DISP_ FAC	NO_ TRT	NO_ TRT	TRT_ AT_ DISP_ FAC	NO_TR T	NO_TR T	NO_TRT	NO_TRT
DISPOSAL_ FACILITY_ REG_CODE	REG-RCRA	CERCL A ON-SITE DISP CELL	CERCL A ON-SITE DISP CELL	REG-RCRA	CERCL A-ON-SITE DISP CELL	CERCL A-ON-SITE DISP CELL	CERCLA-ON-SITE DISP CELL	CERCLA-ON-SITE DISP CELL
PARAM PEDIGREE	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH

The above table identifies the waste by ECES Code (column, differentiating the handling, transportation, and disposal volumes) and the Waste characteristics (row, including waste type, quantity, and disposition location). This was divided this way since the a given waste type may have different transportation methods (i.e., truck or rail), treatment (i.e., none or macroencapsulation), and disposal options.