1.0 PURPOSE

The purpose of this procedure is to ensure consistency and uniformity among cost estimates prepared by FME. The accuracy and validity of a cost estimate are important since these estimates form the basis of funding requests and project cost and schedule baselines. Cost estimates are developed and maintained throughout the life of each project, using the most appropriate estimating technique. This procedure defines and standardizes the requirements for preparation and approval of the Work Order (WO) cost estimates. Preliminary Planning Estimates, which are Rough Order of Magnitude (ROM) estimates, are not used for project baseline formulation, but for determining whether the project, at its earliest stage, is a reasonable undertaking. The WO baseline budgets are established at the Conceptual Authorization (CA) and Fiscal Authorization (FA) stages and modified upon approval of a trend by either the project team or the NCI-Frederick Project Officer and Contracting Officer, as appropriate.

2.0 GENERAL

This procedure is a general guideline and is written to standardize the estimating process within FME. This procedure addresses the steps needed to prepare a standardized, consistent, and traceable cost estimate that is substantiated with appropriate documentation.

2.1 Estimating Guidance and Requirements.

A. This procedure applies to cost estimates that are prepared for facility modifications, renovations, new construction, and dismantlement/demolition projects.
B. These instructions apply to cost estimates that are prepared periodically throughout the phases of project development and construction including formulation, baseline development, procurement, feasibility study, and progress execution.
C. The estimating procedure provides guidance that should be maintained for the preparation of cost estimates; unless specific information is available that provides more accurate material, labor rates, or costs.
D. The source of the cost or rate information should be shown for all items, to assure traceability to the original source.
E. Standard estimate signature and coversheets exhibits 1, 2 & 3 will be used for all estimates to convey the project stage, requirements and approvals.

2.2 Types of Estimates

A. Preliminary Planning Estimates:

The Preliminary Planning Estimate is a Rough Order of Magnitude (ROM) cost estimate and can be prepared for any size project. The Preliminary Planning Estimate will be a parametric estimate based on historical data for similar systems or sub-systems. It is the quickest of the estimates, but also the least accurate. Potential applications for this type of estimate include determining the "Go" or "No Go" status of the work order and authorizes the commencement of preparation of a conceptual authorization estimate or fiscal authorization for jobs estimated to be greater than $5,000, identification of a project as a potential Repair and Improvement project, or a preliminary budgeting tool. The accuracy of the estimate, due to lack of detailed engineering or studies, is not sufficient to establish a basis for funding estimate nor a basis for measurement of performance.

Typical information/input required for Preliminary Planning Estimate development includes:

- Documented Customer Requests or Requirements
- Project Scope Definition
- Facility/Site Utility Requirements and Capacities
- Assessment of Apparent Uncertainties and Risks
- Agreement on the Overall Acquisition Strategy
- Project Team Review

B. Conceptual Authorization (CA) Estimates:

Conceptual Authorization (CA) estimate is the preliminary budgeting estimate. The cost baseline is initially established with the CA estimate. Conceptual Authorization estimates are developed for each project that requires engineering design support. Detailed engineering or studies may be required to further develop the scope of work and assumptions upon which the CA estimate is based. All costs relating to the Estimate at Completion (EAC) for the project, including engineering, design, construction costs, government-furnished equipment (GFE), project management, construction management, quality, contingency for defined in-scope uncertainties and risks, and escalation are

included in the CA estimate. These studies provide a basis for assessing the magnitude of risk and associated contingency and may force improvements in the project scope definition. Total project contingency, should be targeted at 10 percent or less as indicated by the QRAM Procedure (FMEP-G-0180), for defined in-scope uncertainties and risks are included at CA. Scope definition and design should be sufficient to restrict project contingency to this level. Typical information/input required but not limited to, for this estimate is:

- General Scope of Work
- General Site/Building Conditions and Location
- Plot Plan
- Objective Project Schedule Considering Requestor Input
- Preliminary Project Execution Plan
- Mechanical and Electrical Equipment List
- Process Description, if Applicable and Available
- Preliminary Process Flow Diagram
- Preliminary Utilities Summary
- Check List for Offsite Requirements
- Informal Vendor Quotes/Recent Purchase Orders for Major Equipment
- Identify Assumption of Performer Selection, (acquisition strategy) Whether In-House or Out-Sourced Effort
- Assumptions or Exclusions to the Statement of Work (SOW)
- Project Team Review

C. IFA

Internal Fiscal Authorization (IFA) estimates are required for all projects less than $50,000. Estimates are based on detailed requirements identified in the 95% detailed design. The design package includes all drawings, specifications, data forms, bills of material, schedule refinements, definitions of scope, methods of performance, and changes in codes, standards and specifications, the design parameters, space requirements, and operational interfaces. Internal Fiscal Approval for projects valued at less than $50,000 is required prior to solicitation of a construction contractor and/or the commencement of activities.

The IFA estimate is broken down into sufficient detail to reflect virtually every step in the construction process and all material and subcontract work applied to the project. All costs relating to the EAC for the project, including engineering, design, construction costs, GFE, project management, construction management, and quality, contingency for defined in-scope uncertainties and risks, and escalation are included in the FA estimate. Total project contingency, which is determined for the QRAM (FMEP-G-0180) at this stage, is typically about 10%. Typical information/input required for this kind of estimate includes the items used for the CA and the following:

- Complete Design, Including Specifications and P&IDs and Drawings
- Scope of Work
- Acquisition Strategy
- Informal Vendor Quotes
- Major Equipment List
- Construction Schedule
- Site/Building Survey Including Soil Conditions (if applicable)
- FME Job Hours/Cost Estimate (spent to date and to go hours)
- Project Team Review

D. Fiscal Authorization (FA) Estimates:

Fiscal Authorization (FA) estimates are required for all projects greater than $50,000, including those that have an approved CA. Estimates are based on detailed requirements identified in the 95% detailed design. The design package includes all drawings, specifications, data forms, bills of material, schedule refinements, definitions of scope, methods of performance, and changes in codes, standards and specifications, the design parameters, space requirements, and operational interfaces. Fiscal Approval for projects valued at more than $50,000 is required prior to solicitation of a construction contractor and/or the commencement of activities.

The FA estimate is broken down into sufficient detail to reflect virtually every step in the construction process and all material and subcontract work applied to the project. All costs relating to the EAC for the project, including engineering, design, construction costs, GFE, project management, construction management,

and quality, contingency for defined in-scope uncertainties and risks, and escalation are included in the FA estimate. Total project contingency, which is determined for the QRAM (FMEP-G-0180) at this stage, is typically about 10%. Typical information required for this kind of estimate includes the items used for the CA and the following:

- Complete design, including specifications and P&IDs and drawings
- Scope of work
- Acquisition strategy
- Informal vendor quotes
- Major equipment list
- Construction schedule
- Site/Building Survey including soil conditions and renovation (if applicable)
- FME job hours/cost estimate (spent to date and to go hours)

E. Design/Execution Evolution Estimate:

Design/Execution Evolution Estimate is an internal validation required to verify that the design and execution approach remains within the project "design to budget". The Estimating group confirms, using the applicable estimating methodology described I Section 2.3 that the current estimate is financially viable and meets the intended requirements using additional/revised detail provided in the design.

The project has the responsibility to manage the scope of work and design between the CA estimate and the FA estimate. In the event that, even through value engineering and de-scoping of the project, the project didn't meet the target baseline, the change must be communicated to all vested parties at the appropriate level.

Additionally the Estimated Actual at Completion (EAC) used for project reporting, in the period between CA submittal and FA submittal, should be equal to the CA estimate plus any Design/Execution evolution estimates.

F. Equivalent Scope of Service Estimate:

An Equivalent Scope of Services Estimate will be performed for all scope that is to be executed by an outside contractor (entity contracted to SAIC-Frederick). This type of estimate could be an extracted portion of a total estimate or solely built bottoms up estimate for any given scope, using the most applicable estimating approach. The primary purpose of this estimate is to verify the validity of the price quoted by the outside contractor.

G. Trend Estimates:

Trends are prepared in accordance with the Trend Procedure FMEP-G-0120 and worked through the project team. Additional approval requirements may be necessary based on the proposed change and the fiscal impact. Trends are used to track and identify scope changes and project evolution in a timely fashion in order to mitigate serious project problems. Revised estimates may be required when changes in the work are discovered or unknowns are identified. Trends include a clear description of the scope of the change, in addition to cost and schedule impacts. The estimate is detailed, with few or no assumptions. Trends may also be generated when schedule changes affect out-year costs or there are major changes to planning assumptions. Trends are used to document changes to the project's estimated cost at completion; however, inaccurate estimates or cost overruns, unrelated to scope changes are not allowable basis for change to the fiscal baseline.

2.3 Estimating Methodologies

FME's standard estimating approach for engineering, procurement, demolition, renovation or construction projects consists of the following:

- Defining the scope of work and quantifying the work to be performed
- Determining labor requirements to perform the work,
- Calculating labor costs to perform the work
- Planning and scheduling the defined work on a time/logic basis
- Calculating or acquiring the purchased cost of the required installed material
- Calculating the cost of other items required to perform the work

The scope of work is defined through the documentation included with the work order, the CA or the FA; plans and specifications, the project execution plan, and site visits (if applicable). Most estimates are accomplished using a combination of the following generally accepted estimating approaches:

A. Means-Based Estimates – R. S. Means is a leading provider of construction cost information. The Means database and reference guide represent information collected from all facets of the industry and organizes it in an accessible format. Generally, a work statement and a set of drawings or specifications are used to determine the quantities required to complete a project. Labor, equipment and materials and services are applied to these quantities to determine the estimated costs. This technique can be used during several phases of the project estimate by applying useful information to derive construction costs. This method is used for CA estimates, Comparative Cost Estimates and FA estimates for those projects valued at more than $50K.

B. Expert Judgment – This method is sometimes referred to as "grass roots" or "bottoms-up" estimating, because the engineering build-up methodology rolls up individual estimates for each task into the overall estimate. Since Operations and Maintenance shop personnel have experience from previous projects and are familiar with the laboratories, systems, and buildings, shop estimates are based on their expert judgment. The responsible shop foremen participate in a job walk down to assess the accessibility and any difficulties at the work location, such as obstructions, dust control, safety and other factors, and discuss user expectations, all of which are considered when preparing the estimate. The foremen take into account any work that requires coordination with other shops and provide estimates of the labor and material required to perform the work. The shop foremen estimates are prepared and documented on the Shop Estimate Input forms (Exhibit 4). Identified items, as noted above, are quantified from plans, work methods, site visits, and historical data or parameters. Job hours required to complete the defined tasks are estimated, using historical data or the experience of the estimator.

C. Vendor Quotes – Often a project will involve the use of hardware, facilities, or services for which the costs are readily available from vendors. A vendor quote might be used when the vendor is willing to provide informal cost information and the cost estimator has concluded that a better approach does not exist.

D. Parametric Estimating – Parametric estimates are most often used when there are only a few key pieces of data that are known. The implicit assumption of this approach is that the same forces that affected cost in the past will affect cost in the future. Parametric estimating requires historical data based on similar systems or sub systems. Cost data from one of the past projects serves as the basis of the estimate. The cost data is then adjusted upward or downward, depending upon whether the subject project is felt to be more or less complex than the analogous project. Parametric estimates are used primarily for Preliminary Planning Estimates.

E. Market Conditions Adjustment – FME cost estimating uses RS Means as the authoritative source and basis for cost estimates. However, even with applying general conditions and location factors to the RS Means derived estimates, General Contractor bids received by FME on major projects have significantly varied from these estimates. To address this concern, a market condition adjustment has been developed to account for the significant variations and to ensure that the initial FME estimates are more indicative of the anticipated bids.

Bid cost data have been evaluated by division to examine the consistency of cost differences from cost estimates that were based on RS Means. The differences were then expressed in percentage values at the division level.

In order to more accurately reflect General Contractor bid values on major projects, results from the above evaluation were compiled and used to determine a representative cost factor to be applied. To ensure that initial FME estimates are more indicative of the local market conditions, these cost factors will be applied to all RS Means construction estimates when the anticipated acquisition strategy is outsourcing to a General Contractor.

2.4 Basis of Estimate

A clear and concise Scope of Work (SOW) is necessary for the development of any estimate, as are well -defined and documented basis and assumptions essential for every type of estimate. Documented assumptions allow for the tracking and monitoring of changes as they occur during the development of the design. These assumptions are a critical element of the change management process. A schedule developed at the appropriate level of detail for the type of estimate is also required to ensure that staffing requirements and escalation are captured in the estimate.

2.5 Lines of Authority, Duties, and Responsibilities

The requesting program directorate is responsible to generate the MSR (work order) and describe the task. The requesting program directorate also ensures that adequate funding is available to complete the project, as defined, as well as, for changes in work scope, some of which may require Contract Officer Approval (COA).

The Project Manager has the responsibility to coordinate, review and present all major estimates to the directorate customer. The Project Manager is also responsible to have the scope of work (SOW) developed; to review and accept estimates submitted by subcontractors; and to present estimates for subcontracted services to the directorate customer.

The Project Team is entirely responsible for the technical direction and project decisions to expedite performance of small jobs, less than $50,000. This includes the development and refinement of the project work scope, determination of the cost reasonableness of the estimate, evaluation of proposed changes in the project scope and project impacts, and to document approved changes for incorporation into the project baseline. For jobs greater than $50,000, the project team must receive NCI Contract Officer approval prior to execution of any work order or change.

The Project Controls Estimator is responsible to evaluate that the information available is sufficient to complete the desired type of estimate; to prepare the estimate in accordance with FME estimating data or commercially available estimating standards; and as necessary, validate estimates prepared by others.

The Manager of Operations and Maintenance is responsible to evaluate new work orders and determine the lead shop and supporting shops that are required to participate in the job walk downs and estimate preparation.

For FA and IFA estimates, shop foremen are responsible to participate in pre-work "walk-down" to meet with the customer; document the scope of work (SOW) to be performed as discussed with the directorate customer; estimate the materials required to perform the job and identify any major problems or complications. For FA estimates, the shop material and resource planner shall be reconciled with their R.S. Means estimate. The shop foreman are also responsible to identify changes in work scope

encountered during performance of the job or as required by the customer to the Project Manger prior to initiating the change.

The FME Manager of Engineering is responsible to estimate the level of involvement of engineering personnel.

The FME Manager of Project Management and Construction Projects is responsible to review all estimates.

The FME Manager of Project Controls is responsible to approve the basis and underlying assumptions of estimates, to oversee and ensure proper execution of the estimating process.

The FME Director is responsible to review estimates above $50,000.

2.6 Definitions

Contingency – An amount of unallocated budget 10 percent or less of the project cost estimate, managed by the Project Team for the accomplishment of a specific task or set of tasks directly related to the probability of uncertainties occurring. Scope definition and design should be sufficient to restrict project contingency to this level in accordance with the Risk and Contingency Analysis Procedure (FMEP-G-0180).

Cost Estimate – The determination of resource and material quantities and the predicting or forecasting of associated costs, within a defined scope, that are required to perform an effort, whether to operate a facility, renovate or construct a building, manufacture a product, or furnish a service.

Estimating System – The term used to describe policies, procedures and practices for generating cost estimates that forecast the future result in terms of cost, based on information available at the time. Adequate estimating systems are established, maintained, reliable, and consistently applied and produce verifiable, supportable, and documented cost estimates.

Escalation – An allowance to offset the impact of monetary inflation on the current estimated cost of a project. Escalation is used to estimate the future cost of a project or

to adjust historical costs to present value. The anticipated escalation expense shall be identified as a separate line item in the estimate summary.

Management Reserve – An amount of unallocated budget held by the funding customer for management control purposes rather than designated for the accomplishment of a specific task or set of tasks. Management Reserve is not part of the Performance Measurement Baseline; however is included in the contractual agreement for execution of the currently defined scope of the project as presently understood / intended. The funding customer will approve the use of management reserve.

Means Estimating Technique – A reference used by estimators utilizing information collected and published by R. S. Means, a leading provider of construction cost information.

Parametric Estimating – A technique used by estimators, when historical data based on similar systems or sub systems is available, to deduce a reasonable estimate to perform similar activities under similar conditions or as a basis to model correlations between cost drivers and other system performance requirements.

Planned Work Order (WO) – A Maintenance Service Request (MSR) greater than $5,000 for which a project is developed, estimated, reviewed, and approved by the requesting project team before any action is taken to perform the work. Estimates are required for all jobs, including those less than $50,000, prior to initiation of the work. For projects greater than $50,000, Conceptual and Fiscal Authorization estimates and Contracting Officer Approval (COA) are required prior to execution.

Project Team Review – The primary review process for the estimate verification is the Project Team Review. The Project Team Review will ensure the accuracy of the estimate by each Engineering discipline checking that the estimate meets the design requirements and intent of the project, the COTR verifying the construction methodology/means/methods and the Project Manager ensuring the commercial/contractual terms are met. Once all these criteria meet then the estimate will be released to be incorporated into the overall CA/FA package.

Scope of Work (SOW) – Issued in accordance with FME Procedure FMEP-P-210, this document identifies the scope of the project in sufficient detail that a cost estimate can be performed.

Trends – Used to track and identify scope changes and project evolution in a timely fashion in order to mitigate serious project problems. Trends are prepared in accordance with the Trend Procedure FMEP-G-0120 and worked through the project team. Additional approval requirements are based on the change and the fiscal impact.

Unplanned Work Orders – Work Order estimated to cost less than $5,000. These projects typically require only FME shop attention and include trouble calls and special assists.

2.7 Estimating Process Steps

Preliminary Planning Estimates

1. The request is received by FME
2. Customer requirements are documented and project scope defined
3. General assessment of facility/site utility requirements and capacities is performed
4. Apparent uncertainties and risks are identified
5. Acquisition strategy is assumed
6. Estimate is derived for the assumption for the customer to determine the "Go/No Go" status

Conceptual Authorization (CA) Packages

1. The Work Order is received by FME and assigned to a Project Manager
2. Consensus is gained regarding:
   a. Acquisition strategy for design and execution of the project
   b. Scope of work and technical direction
   c. Assumptions and requirements
   d. Project risk and contingency requirements
   e. Preparation of an R.S. Means estimate for approval to proceed
3. The Conceptual Authorization Estimate is presented to the Project Manager for review with the estimator, lead engineer, and other Project Team members, as necessary
4. The estimate is routed for internal approval
5. The estimate is provided to NCI team representative for approval

6. For jobs greater than $50,000, submit conceptual authorization estimate to NCI for approval
7. Upon approval, work, including demolition and conceptual design (15%), can begin

IFA Approved Program

1. For jobs that will be performed by the crafts
   a) The lead shop is assigned
   b) Project Manager, shop personnel, and engineering staff as necessary, work with the requesting customer to clarify work scope and identify any special site conditions
   c) A determination is made whether any other support, such as drafting, engineering or COTR, will be required
   d) FME shops perform material and resource planning effort
   e) The estimate is routed for internal approval
   f) A project plan, including cost estimate, execution schedule, cost savings, program justification for the work, risk assessment and contingency analysis is presented to the Project Team
   g) For jobs < $50K, submit fiscal authorization estimate to The Program for approval
   h) Upon approval, work can begin

2. For jobs that will be outsourced
   a) Internal Fiscal Authorization estimates are prepared using engineering design documents when the design is between 95% and 100% complete. (Design Review Board recommends revisions/corrections complete.
   b) The estimating group will prepare a “take-off” estimate (R.S. Means and shops material and resource planning) to be presented to the project team and routed for internal approval.
   c) The estimate is routed for internal approval.
   d) A project plan, including cost estimate, execution schedule, cost savings, program justification for the work, risk assessment, and contingency analysis is presented to the Project Team.
   e) For jobs <$50K, submit fiscal authorization estimate to The Program for approval.
   f) Upon approval, work can begin.

g) For projects less than $50,000, in addition to Project Team approval

Fiscal Authorization Packages

3. For jobs that will be performed by the crafts
   a) The lead shop is assigned
   b) Project Manager, shop personnel, cost estimator, and engineering staff as necessary, work with the requesting customer to clarify work scope and identify any special site conditions
   c) A determination is made whether any other support, such as drafting, engineering or COTR, will be required
   d) The cost estimator prepares the R.S. Means Estimate for jobs >50K.
   e) FME shops perform material and resource planning effort
   f) For jobs > $50K the Shop material and resource planning will be reconciled with R.S. Means
   g) The estimate is routed for internal approval
   h) A project plan, including cost estimate, execution schedule, cost savings, program justification for the work, risk assessment and contingency analysis is presented to the NCI team representative for approval
   i) For jobs > $50K, submit fiscal authorization estimate to NCI Contracting Officer Approval (COA) for approval is required prior to execution
   j) Upon approval, work can begin

4. For jobs that will be outsourced
   a) Fiscal Authorization estimates are prepared using engineering design documents when the design is between 95% and 100% complete. (Design Review Board recommends revisions/corrections complete.
   b) The estimating group will prepare a “take-off” estimate (R.S. Means and shops material and resource planning) to be presented to the project team and routed for internal approval.
   c) For projects greater than $50,000, in addition to Project Team approval, Contracting Officer Approval (COA) is required prior to execution
   d) A project plan, including cost estimate, execution schedule, risk assessment and contingency analysis is presented to the NCI team representative for approval.

e) For jobs >$50K, submit fiscal authorization estimate to NCI Contracting Officer Approval (COA) for approval is required prior to initiating the procurement action.
f) Upon approval, activities can commence.
g) Upon approval, construction can commence

Exhibit 1	Sample Preliminary Estimate
Exhibit 2	CA Estimate, including Cover Sheet, Construction Cost Estimate, Project Management, Engineering & COTR (PME) estimate and QRAM
Exhibit 3	FA Estimate, including Cover Sheet, Summary Sheet, Construction Cost Estimate, Project Management, Engineering & COTR (PME) estimate and QRAM
Exhibit 4	Shop Estimate Input Forms