



**Haulsey Engineering, Inc.
Quality Management System (QMS)**

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1.0 Introduction

In order to meet customer requirements and enable employees to do work correctly the first time, Haulsey Engineering Inc. (HEI) has established a policy and program requirements for the preparation and implementation of quality management systems. The policy requires that all HEI organizational units participate in a centrally managed quality assurance (QA) program. This system provides the necessary elements to plan, implement, document, and assess the effectiveness of quality assurance (QA) and quality control (QC) activities conducted by HEI. The intent is to develop a consistent approach to producing services that satisfy customer requirements and expectations, are scientifically sound, legally defensible, and of known documented quality.

HEI requires each organizational unit and / or project to develop a quality management plan (QMP). The QMP is the HEI management statement of the process that will govern QA activities for the organization. The QMP defines the HEI QA related policies, areas of application, roles, responsibilities, and the management and technical practices that assure the work produced is:

- of adequate quality and usability for their intended purpose and,
- where necessary, legally and scientifically defensible.

HEI management is responsible for ensuring that QMP is implemented. Senior managers and project / program managers are responsible for:

- ensuring that all quality components comply fully with the requirements of the quality plan
- ensuring that quality management is an identified activity with associated resources adequate to accomplish the QMP goals
- ensuring that training is available in the fundamental concepts and practices of quality, quality management and the QA and QC activities that employees may be expected to perform
- performing periodic assessments of quality programs to determine conformance to plan and the effectiveness of implementation
- ensuring that deficiencies are highlighted in the assessments and are appropriately addressed
- identifying training needs for all levels of the organization
- ensuring that performance plans for project managers, senior managers, and appropriate staff contain critical elements that are commensurate with the quality management responsibilities assigned by the QMP.

1.1 Quality Management Policy and Practices

HEI's quality management policy focuses on four operating principles: *assistance, flexibility, value-added, and continuous improvement*. HEI quality staff provides *assistance* to project managers and project personnel with quality tools necessary to implement their programs. The quality program is *flexible* in

that all QA policies and requirements should, at a minimum, provide *value* to the body of information collected on the project or to the processes used in producing the information. HEI strives for *continuous improvement* by constantly evaluating the system to identify problem areas, potential issues of concern, and areas for improvement and then developing and implementing corrective actions to address them.

Haulsey Engineering, Inc. is committed to providing the finest array of engineering and technical support services to it's' clients and as such must depend on exacting quantitative and qualitative standards. Client decision makers must be able to use HEI products and services with some level of confidence in order to make informed decisions. **It is the policy of Haulsey Engineering, Inc. to ensure that all services provided are of adequate quality for the intended use.** This overarching quality management policy is implemented through a series of policies and practices that are described below.

Policies and Practices

Allocation of appropriate resources	HEI management will allocate appropriate resources to meet the quality system goals and requirements outlined in the Haulsey Engineering, Inc. QMP
Inclusion of quality management in daily activities	It is the HEI policy that the quality system must be implemented in daily activities of HEI staff. The policy is fostered through training of all staff on the quality system philosophy, requirements, tools, and reference documents. In addition, the Quality Manager is involved in a supporting role at the project level. HEI policy stresses management's responsibility to create an environment in which all personnel contribute to producing high quality work
Systematic planning	It is HEI policy that quality can only be achieved through systematic planning, assessment and corrective action. Every project undertaken by HEI must have clear objectives and a detailed plan to meet those objectives. This is accomplished by employing a thorough systematic planning process at the initiation of any client-related work.
Quality system documentation	It is HEI policy that appropriate quality system documentation will be developed for any client related work.
Provision of quality training	HEI policy requires the training of all staff on the quality system requirements, available quality implementation tools, and reference and guidance documents to assist them in providing client service, meeting HEI quality goals.

HEI recognizes that a "one size fits all" approach to quality requirements will not work due to the variety of client needs and projects undertaken. Therefore, the implementation of the HEI quality system is based on a **graded approach**. This means that quality systems for different projects vary according to the specific objectives and needs of the client organization. A graded approach is also applied

to quality system documentation. The level of effort needed to develop and document a quality system should be based on the scope of the program and the nature of the decision. Similarly, the level of detail for quality documentation of specific projects varies according to the complexity of the work being performed and the intended use of the information produced. Examples of this philosophy are discussed in the QMP.

2.0 Quality System Components

HEI is committed to implementing a quality management program that provides the necessary management and technical practices that ensure the services produced are of adequate quality and usability for their intended purposes. HEI uses a wide variety of quality management practices and tools to implement its quality system including:

- quality management plans
- project quality objectives and systematic planning
- quality system documentation
- quality training
- quality management monthly reporting
- senior management quality review
- quality annual review and workplan
- quality system and technical system audits
- quality peer review
- final report review

2.1 Quality Management Plans

The Quality Management Plan (QMP) serves dual purposes, it documents the quality approach on all work and it also communicates the system to all staff. The structure, designed with adaptation in mind, is for use by all staff and must be approved by senior management.

2.2 Project Quality Objectives and Systematic Planning

A crucial component of the HEI quality system is up-front systematic planning. Although projects vary greatly in scope and importance, each should be started in essentially the same way – by determining the level of quality required and planning for it accordingly. Consistent with the HEI graded approach, the level of quality required will be determined by evaluating the importance of the activity in relation to the objectives of the project, available resources, the unique needs of the client organization, and the potential consequences of errors in the work to the client. A systematic process is used to facilitate the planning of collecting and analyzing data. It asks the project team to focus their planning efforts by specifying 1) the intended use of the data, 2) the analytical criteria to be used 3) an acceptable probability threshold for making an incorrect assumption based on the data. The process should:

- establish a common language to be shared by analytical decision makers, technical personnel and client subject matter experts in discussion of project objectives and data quality
- provide a mechanism for paring down a multitude of objectives into major critical objectives
- facilitate the development of clear statements of project objectives and constraints and
- provide a logical structure within which an iterative process of design, feedback and guidance may be accomplished efficiently and cost effectively

At a minimum, all HEI projects must contain the following quality elements in the systematic planning:

- Problem Identification – What is the client problem
- Project Purpose – What is the primary purpose of project activity, why it can solve the client problem, what is the schedule for completion, and who and/or what is driving the schedule
- Project Design – What are the quality requirements of the project, what is the allowable level of uncertainty (quantify or qualify it), if data are required, what kind are needed, how will they be collected, and what are the quality requirements.
- Resource Requirements – What activities must be performed, what staff members are needed/available to complete the activities, what resources and materials are needed/available, what options, if any, exist, can requirements be achieved on schedule and within budget using available technical, financial and staffing resources
- Roles, Responsibilities and Project Products – who is the customer and what are his/her expectations, who are the project team members and what are their respective roles/responsibilities, who, if any are suppliers to the project

- Performance Measures – What is success and how is it defined (quantify and /or qualify it)

2.3 Quality System Documentation

It is critical to the HEI quality system to document the quality planning process. The six steps described above forms the basis of the quality system document. While execution of the planning process may yield technically sound results, lack of proper documentation can make data suspect and the defense of the project difficult if not impossible. As previously discussed, the varied nature of projects may require greater or lesser degrees of documentation, but using the graded approach there are, at a minimum, eight elements of the planning process that must be documented:

1. Identify the project manager, the sponsoring organization and the organizational stakeholder or champion, the project personnel, “suppliers” to the project, and the roles and responsibilities and involvement of all.
2. The project goal, objectives, and the questions and issues to be addressed.
3. The project schedule, resources, budget, and milestones, and any applicable external requirements (e.g. regulatory or statutory)
4. The type of data or information needed and how it will be used to support the project objectives
5. How the quantity of information needed was determined and how the criteria for the quality of information was determined
6. How, when , and from where data/information will be obtained, including existing data/information, and identify any existing constraints on the information collection process
7. Specification of the information collection process (i.e. field visits, audits, interviews, technical reviews, etc.)
8. How the information for the project will be analyzed, evaluated and assessed against the performance criteria established above.

The documented quality system plans are submitted to the assigned Quality Management Team (QMT) member, who reviews the documentation to ensure that the technical requirements of the project are clearly met. If approved by the QMT member, documentation is forwarded to the Quality Manager for final review and approval. Once approved, the QMT employs formal procedures for logging and tracking all plans and subsequent changes. As part of these tracking procedures, the QMT uses a Quality System Documentation Status and Tracking Sheet to monitor fulfillment of documentation requirements. All submitted documents are maintained in hard and soft copy (where appropriate). The QMT conducts a standardized review using the checklist to document the acceptability of the all applicable requirements and determines that quality requirements are:

- included and acceptable
- included and not acceptable
- not included

➤ not applicable

After completing the review, the QMT provides a cover memo and checklist sheet with comments to the Project Manager detailing conclusions, recommendations, and any required revisions. When revisions are required, the documentation is resubmitted and reviewed by the quality team member. The Quality Manager is made available to assist the project team with understanding and meeting the quality system requirements and will participate in meetings if requested by the Project Manager.

Documentation is archived in accordance with HEI standard operating procedure and client legal and administrative requirements.

3.0 Quality Training

The success of any quality management program ultimately lies with the personnel who implement the program on a daily basis. HEI must not only support activities that will satisfy the mandatory requirements of the quality management program, but also instill the philosophy of improving activities to provide the highest quality of work in a cost-efficient manner. To that end, it is HEI policy to provide the quality training necessary to ensure that all staff understands and uses the quality system. The following describes the quality system training program.

3.1 Quality Manager Training

The Quality Manager is required, in addition to successfully completing the HEI Quality Management Training course; participate in training courses on quality management topics relevant to HEI quality. Additionally, the Quality Training Manager is expected to attend all local, regional and national meetings, seminars, conventions, conferences on quality management systems and the development of quality management materials and protocols relevant to HEI quality. The Quality Manager is expected to ensure all HEI personnel receive up-to-date training on a variety of quality assurance subjects

3.2 HEI Personnel Quality Training

HEI supervisors are responsible for ensuring that staffs have the qualifications to do their jobs properly, including activities related to the quality system. Managers are responsible for discussing quality training needs, at a minimum, during mid-year and annual personnel performance evaluations. In addition, because they are responsible for the quality of work produced by their staffs, supervisors must receive necessary training to ensure their understanding of the importance of the quality system, their responsibilities as managers, and specific quality policies and procedures.

It is mandatory that training schedules be developed and posted conspicuously for all quality training. The training may consist of seminars, classes, or with senior management approval, on-the-job training. If training cannot be met through in-house expertise, it may be accomplished through external organizations. It is the responsibility of project leads to make sure all reporting personnel are aware of the training opportunities. It is the Training Managers responsibility to provide the following training every two (2) years:

- Overview of the HEI Quality Management System
- Quality Assurance Project Plan Development
- HEI Quality System Training for Project Managers and Senior Management
- Auditing and Data Verification / Validation Techniques

The Quality Manager must develop a library of pertinent quality management documentation to assist the HEI technical staff. The library must contain documentation as well as software training programs. The minimum required quality management training for HEI staff is detailed in the following table:

Quality Management Training Requirements for HEI Staff

Position	Quality Management Training Requirement
Senior Managers	<ul style="list-style-type: none"> • Overview of HEI QMS (every two yrs) • Orientation to QA for Managers (1 time only)
Project Mgrs, Work Assignment Mgrs., Project Leads	<ul style="list-style-type: none"> • Overview of HEI QMS (every two yrs) • HEI Quality System Training for Project Leads (every 2 yrs.)
HEI Quality Management Team	<ul style="list-style-type: none"> • Overview of HEI QMS (every two yrs) • Development of QA Project Plans (1 time only) • Data Quality Assessment (1 time only) • Development of Quality Management Plans (suggested course)
All HEI involved in the generation or use of project information	<ul style="list-style-type: none"> • Overview of HEI QMS (every two yrs)

Attendance at the courses is recorded and attendees receive a written record form the Quality Manager or instructor after completion of the course. The Quality Management Team maintains records of the quality system training taken by personnel in each HEI office. A summary of the quality system training is provided in the annual report, including but not limited to, a list of the courses offered, and the number of attendees. Whenever a new Quality Management Program is developed or whenever a significant revision is conducted, training must take place within 6 months of the approval of the Quality Management Plan by HEI's Quality Manager and senior management.

4.0 Quality Management Team Monthly Reporting

All Project Managers actively engaged on client projects must attend and present a status report on quality management activities associated with their respective projects each month. The meeting is chaired by the Quality Manager, who uses a master quality assurance status tracking sheet to review and summarize activities. Each Project Manager is responsible for ensuring complete and up-to-date information is available to the Quality Manager, prior to the scheduled meeting. Project status, requirements, issues, and resource requirements and allocations, and risks are reviewed and when necessary, fixed. The meeting results are recorded and reported to senior management, which uses the reports as a management tool to evaluate project performance as well as ongoing quality requirements.

5.0 Senior Management Quality Reviews

Recently, HEI established a semi-annual quality management review involving the Quality Manager and senior management to quickly remedy any pressing quality deficiencies or persistent patterned problems that have bubbled up from the monthly reviews and to calibrate them with the bi-annual planning process. These sessions serve to close the loop on the quality system cycle from planning and implementation to assessment and applying corrective action when needed.

6.0 Annual Quality Report and Workplan

Each HEI Project Manager is required to submit a quality assurance annual quality report and workplan to the Quality Manager. The report summarizes project quality activities during the year, based largely on input from the monthly review sessions, and also includes a tentative workplan that incorporates quality successes, lessons learned, and corrective actions taken. The tentative workplan is negotiated between the Project Manager and the Quality Manager into a quality performance agreement for the coming year. The annual review and performance agreement are then used as quality assessment tools by the Quality Manager and senior management.

7.0 Quality System Audits and Technical Reviews

Quality system audits and / or technical system audits are on-site evaluations by internal and / or external parties to determine if the organization is implementing a satisfactory quality management program. They are used to determine adherence to the program, the effectiveness of the program, and the adequacy of allocated resources and personnel to achieve and ensure quality in all activities. Internal audits are conducted by HEI senior management. External audits are conducted by client customers, i.e. governmental entities and are subject to client requirements. Technical audits are qualitative on-site evaluations of all phases of projects that have highly stringent data collection and analyses standards. These audits can and usually are conducted prior to or during data

collection activity, in order to effectively evaluate requirements before data is collected. The number and frequency of audits are dependent on the length of the project, the importance of the project objectives, and input gleaned from the numerous quality reporting mechanisms in place and mentioned above designed to assist senior managers in assessing quality.

8.0 Quality Peer Review

HEI has a required quality peer review process that is incorporated into the analysis phase of all projects produced by the organization. This in-depth review is an assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, design, and conclusions of the project. On any scientific or technical work the review also serves to determine if any or all parts of the work product meets major status. The determination that a scientific or technical product is “major” is based on whether it meets at least one of the following criteria:

- does it support major regulatory or policy / guidance of national effect?
- does it establish a significant precedent, model or methodology?
- does it address controversial issues?
- does it focus on significant emerging issues?
- does it consider an innovative approach for a previously define problem/process/methodology?
- does it satisfy a statutory or legal mandate for peer review?

The Quality Manager is notified by the Project Manager when a project team is prepared to issue an analysis to a client problem. The Quality Manager selects a team of three HEI peers who are not associated with the project and have no advanced knowledge of the work. The peer “team” is provided drafts of the proposed analysis and thoroughly reviews the contents. Under the direction of the Quality Manager, the peer team meets with the Project Manager to discuss the peer findings. Approval by the peer group renders analyses ready for drafting of the final report.

9.0 Quality Final Report Review

If previous QA efforts are successful, this review will focus on the manner, clarity, and completeness of the presentation, together with editing/proofreading written documents. However, should a problem such as faulty analysis or an inappropriate assumption be discovered in the product, this review will provide a final opportunity to ensure that suitable corrective action is taken. The Project Manager is responsible for using the HEI final report criteria and upon completion of the final draft must submit it to the Quality Manager for final review and signature.

9.1 HEI Written Documents Standards

- *Summary* At first reading, does it appear to be concise? At second reading, does it accurately and clearly summarize the most important elements of the rest of the report? Does it focus attention on the highly significant points? Does it confine itself to what is found in the body of the report?
- *Statement of Purpose of the Work* - Does it correctly and clearly state the purpose of the work required by the client?
- *Background of the Problem* - Are circumstances described related to the assigned task? Is information provided on previous work and a solution obtained which describes the reasons for adopting the methods used in the study?
- *Procedures, Methods of Solving Problems, Difficulties Encountered* - Do the procedures and plan of investigation appear to be technically sound? Can they be understood without questioning the author? Does it appear that the plan was the most economical and expeditious way of doing the job? (This question will help subsequent studies.) Are detailed procedures provided or included in the appendix?
- *Analysis of Findings* - Is the analysis technically sound? Is it developed in a logical sequence? Is it clearly based on the data presented in the report? Are the results mathematically correct? Does the analysis persuasively use the data to identify the cause of the problem and point toward feasible solutions?
- *Conclusions* - Do the conclusions logically flow from the analysis? Are they technically valid? Will they satisfy the reader that the characteristics and sources of the problem have been thoroughly identified and analyzed, and that the sound basis for solutions is now available?
- *Recommendations* - Are the recommendations based on the data, analyses and conclusions? Are they technically feasible? Are they economically feasible? Do they provide a complete solution for the problem; if not, do they propose feasible ways of accomplishing further corrective actions? Are recommendations made for work on any new problems uncovered by the study?
- *Appendices* - Are the appendices necessary? Do they present the material referenced in the text?

9.2 HEI Drawings and Technical Illustrations Standards

- *Title Block* - Is it the correct block for the task and customer? Are the title, drawing number and revision level correct? Are all the necessary signatures and dates in place?
- *Revision Descriptions* - Are they sufficiently explicit, providing the zone and description of the change? Is the appropriate authority cited? Are they signed and dated?
- *Notes* - Are all the general notes applicable to this project included? Are all the unique requirements of this drawing addressed? Are spelling, grammar, and punctuation correct?

- *Views* - Are all views properly labeled, based on the zone and the point of view? Are the descriptions and numbering systems consistent and are the section arrows labeled to match the actual view? Are they accurate, based on the locations of the section arrows?
- *Lines* - Are line weights correct? Are hidden lines, center lines, and other special items depicted by the appropriate line types?
- *Symbols* - Are find numbers, revisions, welds, and other special items properly identified?
- *List of Materials* - Do find numbers and quantities match the drawing field? Are items properly identified? Are unit weights given?
- *Weight Block* - Are all the weights and their locations considered? Is there an entry for every revision of the drawing

9.3 Acceptance and Delivery

Once a document is acceptable to both the Quality Manager and Project Manager, it is delivered to the customer. A letter of transmittal will accompany all submittals. In the case of draft and preliminary submittals, this letter will describe known deficiencies and voids, and the actions which HEI will take, or requests for action from the client to rectify these problems prior to any subsequent submittal. Delivery is in accordance with the requirements of the delivery order and HEI.