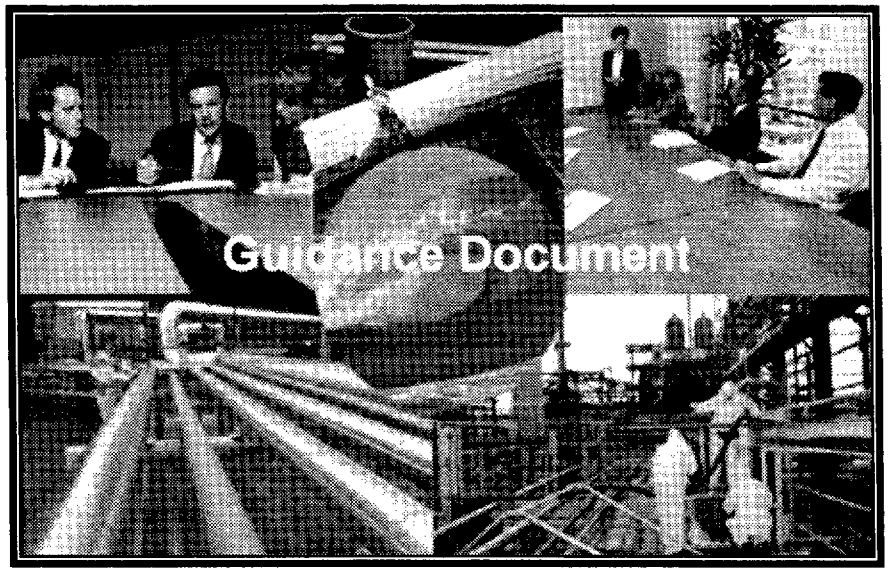
American Petroleum Institute

Guidance Document for Model EHS Management System

A Manual to Assist Companies Interested in Developing an EHS Management System or Enhancing an Existing System

API Publication 9100B
October 1998



STEP
Strategies for Today's Environmental Partnership

American Petroleum Institute

American Petroleum Institute Environmental, Health and Safety Mission and Guiding Principles

STEP

MISSION

The members of the American Petroleum Institute are dedicated to continuous efforts to improve the compatibility of our operations with the environment while economically developing energy resources and supplying high quality products and services to consumers. We recognize our responsibility to work with the public, the government, and others to develop and to use natural resources in an environmentally sound manner while protecting the health and safety of our employees and the public. To meet these responsibilities, API members pledge to manage our businesses according to the following principles using sound science to prioritize risks and to implement cost-effective management practices:

PRINCIPLES

- To recognize and to respond to community concerns about our raw materials, products and operations.
- To operate our plants and facilities, and to handle our raw materials and products in a manner that protects the environment, and the safety and health of our employees and the public.
- To make safety, health and environmental considerations a priority in our planning, and our development of new products and processes.
- To advise promptly, appropriate officials, employees, customers and the public of information on significant industry-related safety, health and environmental hazards, and to recommend protective measures.
- To counsel customers, transporters and others in the safe use, transportation and disposal of our raw materials, products and waste materials.
- To economically develop and produce natural resources and to conserve those resources by using energy efficiently.
- To extend knowledge by conducting or supporting research on the safety, health and environmental effects of our raw materials, products, processes and waste materials.
- To commit to reduce overall emission and waste generation.
- To work with others to resolve problems created by handling and disposal of hazardous substances from our operations.
- To participate with government and others in creating responsible laws, regulations and standards to safeguard the community, workplace and environment.
- To promote these principles and practices by sharing experiences and offering assistance to others who produce, handle, use, transport or dispose of similar raw materials, petroleum products and wastes.

Rev. November 1996

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API Publication 9100A, *Model Environmental, Health and Safety (EHS) Management System,* was developed as a voluntary tool or template to assist companies interested in developing an EHS management system or enhancing an existing system. The model, which applies a quality systems approach to managing EHS activities, focuses on people and procedures by pulling together company EHS policies, legal requirements, and business strategies into a set of company or facility expectations or requirements to achieve continual improvement in overall EHS performance consistent with company policies. It is intended to be flexible and adaptable to fit the size and complexity of a company's or facility's operations. Those who use this model should refer to the companion document, API Publ. 9100B, *Guidance Document for Model EHS Management System,* for additional information.

API Publication 9100B, *Guidance Document for Model EHS Management System,* provides assistance to corporate and operating organization employees who are developing, implementing and assessing environmental, health and safety management systems. The guidance document serves as self-study source material, explains the basic purpose and scope of management systems, enhances efficiency of interchange among employees by use of common terminology, clarifies relationships between operating and other systems, describes how to evaluate effectiveness of an EHS management system and its elements, and facilitates system continuity over time. Those who use this guidance document should be familiar with API Publ. 9100A, *Model Environmental, Health and Safety (EHS) Management System.*

GUIDANCE DOCUMENT FOR MODEL EHS MANAGEMENT SYSTEM

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OVERVIEW

Purpose of Guidance Document for Model EHS Management System

The purpose of this guidance document is to assist employees who are developing, implementing and working with environmental, health and safety management systems. The guidance document is intended to:

- serve as self-study source material, which can be used for other related training;
- enhance efficiency of interchange (between individuals, operating organizations, and companies) through the use of common definitions and terminology; and
- provide continuity of an EHS management system over time.

Objectives

The objectives of this document are to provide information that will enable you to:

- more easily implement an EHS management system at a company or facility;
- understand the basic purpose and scope of EHS management systems (EHS MS);
- be familiar with the definition of a management system;
- clarify the relationship between operating and other systems and an EHS management system;
- understand and describe the characteristics of an effective management system; and
- understand and describe how to evaluate an EHS management system and its elements.

Target Audience

This guidance document may be used by any operating organizations involved in the development, implementation, or assessment of EHS management systems. Persons who carry out their work within the framework of operational management systems may also benefit from this information.

Prerequisite Knowledge

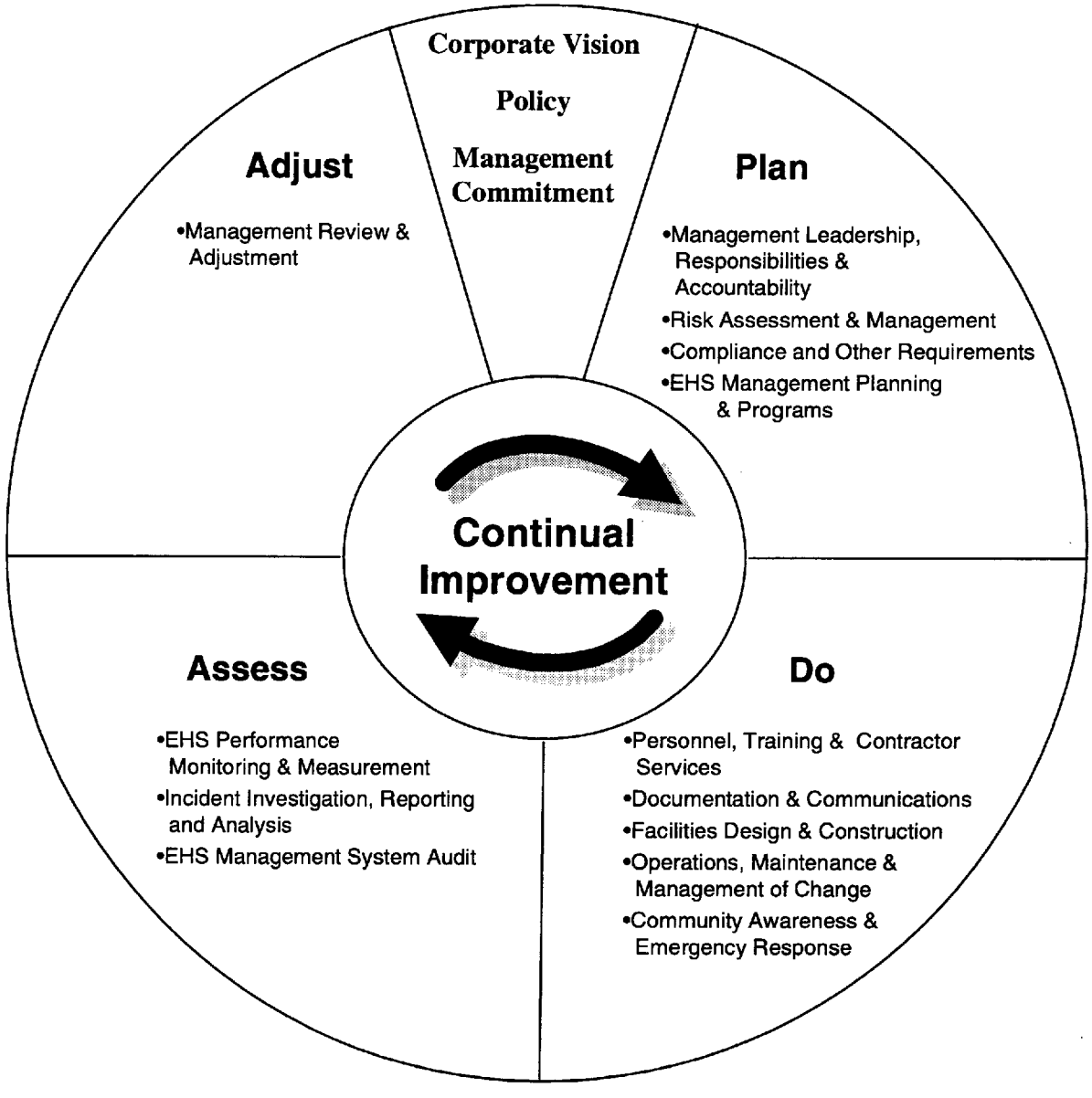
Those who use this guidance document should be familiar with the Model EHS Management System, Publication 9100A, and existing company EHS policies, procedures, programs, and operating and management systems. Figure 1 summarizes the overall scope of the Model EHS Management System.

How to Use This Document

You should go through the document at your own pace. Sections 1, 2 and 3 can be completed in about 15 to 30 minutes. Section 4, Glossary, and Section 5, Appendixes, provide additional reference materials that some companies may find useful.

Figure 1

API MODEL EHS MANAGEMENT SYSTEM



1.0 DEFINITION AND CHARACTERISTICS OF EHS MANAGEMENT SYSTEM

Key terms must be defined so that the management system can be applied and discussed in a consistent manner throughout organizations and among companies. This also prevents misapplication of terminology or definitions from other sources, such as ISO 14001 or 14004. Although definitions from other sources may be perfectly adequate, the following definitions are used in the Model EHS Management System. As companies or organizations adapt this model system or comparable systems to their particular operations, modified definitions of some terms may be necessary to reflect particular company practices.

1.1 Management System Definition

For purposes of the Model EHS Management System, a **system** is defined as:

> A series of steps taken to ensure that stated objectives are achieved. Typical steps or elements of an EHS management system are shown in Table 1.
>
> A typical system includes consideration of four key characteristics: scope and objectives, documented procedures and resources for implementation and execution, a verification or measurement process to determine if results are being achieved, and a feedback mechanism to provide for continual improvement. These key characteristics provide the basic structure for a quality systems approach, which is often referred to as: "plan, do, assess, and adjust" (see Figure 1)."

Table 1 **KEY ELEMENTS OF API MODEL EHS MANAGEMENT SYSTEM**

- POLICY & PLANNING *[PLAN]*
  1. Management Leadership, Responsibilities & Accountability
  2. Risk Assessment & Management
  3. Compliance and Other Requirements
  4. EHS Management Planning & Programs
- IMPLEMENTATION & OPERATIONS *[DO]*
  5. Personnel, Training & Contractor Services
  6. Documentation & Communications
  7. Facilities Design & Construction
  8. Operations, Maintenance & Management of Change
  9. Community Awareness & Emergency Response
- MEASUREMENT & CHECKING *[ASSESS]*
  10. EHS Performance Monitoring & Measurement
  11. Incident Investigation, Reporting and Analysis
  12. EHS Management System Audit
- MANAGEMENT REVIEW & CONTINUAL IMPROVEMENT *[ADJUST]*
  13. Management Review & Adjustment

Throughout this document, the terms system and management system are used interchangeably. The key characteristics of the system are described in Section 1.2.

Thus, an **EHS management system** is defined as:

> A continual improvement process that applies a quality systems approach to managing environmental, health and safety activities. It consists of responsibilities, procedures,

processes, and resources that need to be in place to fully integrate safety, health, and environmental issues into business operations.

1.1.1 *Differences Between System and Other Terms*

To ensure consistent interpretation by those using the API model, several key terms, such as element, objective, organization, procedure, practices, program, process, and target are defined as follows:

Element: A key component of a safe, healthy, and environmentally sound operation. The Model EHS Management System has 13 elements.

Objective: A desired endpoint that helps achieve compliance with an organization's policies or otherwise improves performance.

Organization: The group that is implementing the management system. This term may be applied to an individual facility, business unit, operating sector, company, corporation, or any combination thereof.

Practice: Methods or means of accomplishing stated tasks.

Procedure: A step or series of steps to be carried out in logical order in a given situation.

Process: A series of actions, changes or functions that bring about an end or result.

Program: A plan of action that includes scheduled events or activities.

Target: Milestones that must be achieved, or actions completed, within a specified time to meet an objective.

Other terms, which are used less frequently in the model, are defined in Section 4 - Glossary.

1.2 Key System Characteristics

A complete management system, as defined above, has four key characteristics: (1) scope and objectives, which define the boundaries of the system; (2) documented procedures, and responsible and accountable resources; (3) measurement and verification; and (4) feedback or review mechanisms leading to continual improvement of the management system.

The Model EHS Management System (EHS MS) is a tool or template to help members, industry sectors, and others develop or enhance an EHS MS. It is not expected that this particular system necessarily be used. Companies may choose to organize their management systems differently depending upon other existing systems and/or procedures that are to be incorporated into their own management systems, or emphasis that company management may want placed on certain system elements. The Model EHS MS is intended to be flexible and adaptable by scaling up or down to fit the size and complexity of a company's or facility's operations.

Management system documentation is important. The reasons for documenting a system are:

- It describes the function and form of the system and gives it substance;
- It has longevity and will continue to survive personnel changes (i.e., transfer, retire, etc.); and
- People associated with the system have a common understanding of the system.

1.2.1 *Scope and Objectives* [PLAN]

Characteristic components of the scope and objectives portion of the EHS management system are:

- A clearly defined purpose with specific objectives for the system;
- System scope, including boundaries, explaining what the system does and does not cover;
- Operating requirements that the system is designed to satisfy; and
- Expected results or outcomes of the system.

In the Model EHS management system, the ***"PLAN"*** portion of the system includes the following four elements (expectations for each element are included in the appropriate box):

1. Management Leadership, Responsibilities & Accountability

- Policies established & communicated
- Management active & visible at all levels
- Operations management sets scope
- EHS responsibilities clearly defined
- EHS performance recognized and included in appraisal process
- Employees actively involved
- Clear goals & objectives set and communicated

2. Risk Assessment and Management

- Identify EHS hazards & assess consequences & probabilities
- Conduct assessments periodically
- Prioritize hazards & document decisions
- Update as changes occur
- Part of acquisition and divestiture of assets
- Product safety information is accurate & available

3. Compliance and Other Requirements

- Requirements are known
- Procedures exist to periodically assess compliance
- Non-compliance incidents are analyzed & learnings shared
- Participates in development of new requirements where appropriate
- Emerging compliance issues are monitored
- Emerging requirements are communicated

4. EHS Management Planning & Programs

- EHS objectives and targets align with company EHS policies
- Programs, standards & procedures are established & maintained
- Process are in place to amend as needed

1.2.2 *Procedures and Resources* [DO]

Procedures, and responsible and accountable personnel and resources to carry out the procedures, are core characteristics of any management system. There needs to be clear documentation; and, individuals involved with the system need to understand their roles and responsibilities in ensuring effective application of the management system throughout a company's operations. The amount of documentation that is necessary depends on the system's complexity.

The ***"DO"*** portion of the Model EHS management system includes the following five elements (expectations for each element are included in the appropriate box):

5. Personnel, Training & Contractor Services

- Process to assess qualifications, abilities and competencies
- Initial, ongoing & refresher training
- Process to manage personnel changes
- Procedures focused on practices to prevent injuries & illnesses
- Employee performance evaluation linked to EHS performance
- Selection criteria for contractor services
- Contractor performance requirements defined & communicated
- Periodic assessment of contractor performance

6. Documentation & Communications

- Operation & maintenance documentation identified, accessible & current
- Information on material & process hazards communicated
- Potential material hazards for safe handling and disposal communicated and documented
- Records for operations, maintenance, inspections, facility changes, training, audits and reviews maintained and protected
- Procedures for records retention, review and updating are documented
- Open communication on EHS matters is encouraged

7. Facilities Design & Construction

- EHS personnel involved in all stages
- Practices & standards meet or exceed regulatory and/or policy requirements
- Quality control & inspections systems
- Deviations are reviewed, approved & documented
- Pre-startup reviews
- EHS risk assessments made at specified project stages

8. Operations, Maintenance & Management of Change

- Operating, maintenance & inspection procedures
- Work permit system & operating procedures in place to manage hazards
- Alarm, control & shutdown equipment and procedures
- Waste & emissions monitoring, control & prevention practices
- Facility design, operation & maintenance to minimize wastes & emissions
- Procedures to manage all operational facility changes
- Expectations & procedures in place for off-site work activities

9. Community Awareness & Emergency Response

- Ongoing dialogue to address community concerns and expectations
- Comprehensive emergency response & crisis management plans in place
- Equipment, facilities, trained personnel defined, available & tested
- Simulations & drills held to verify response capabilities

1.2.2.1 Procedures for Process Steps and System Tasks

Two types of procedures are integral to a system, both of which need to be documented. The first type of procedure addresses the process steps of the management system itself. A flow chart or similar type of diagram may be useful in documenting these process steps.

The second type of procedure lists the various steps for key system tasks. These procedures should be clear, easy to follow, and kept current. Properly written procedures will address safety precautions to be observed, and facility operations during normal and abnormal (i.e., emergency) situations. These types of procedures are not normally kept with the overall management system documentation, but typically are contained in safety or operating manuals. Examples of written procedures for system tasks could include forms, and instructions for their completion, and elaboration of steps to be performed to complete various actions.

1.2.2.2 *Responsible and Accountable Resources*

In addition to the procedures mentioned above, it is equally important to establish clear roles, responsibilities and approval authorities for a system. Communication of the management system requirements and responsibilities is necessary to ensure that all individuals involved understand the objectives of the system and their specific responsibilities related to the system.

Several factors, as outlined below, should be considered when assigning responsible and accountable resources.

- Assign a person or persons responsible for system administration;
- Define specific roles and necessary skill requirements for key personnel involved with the management system;
- Assign approval authority to allow personnel to carry out the duties of their assigned roles;
- Identify experience levels and/or training (both initial and refresher) that qualify a person to carry out the responsibilities assigned under the management system; and
- Allocate resources sufficient for personnel to carry out their responsibilities.

1.2.3 *Measurement and Verification* [ASSESS]

The third or ***"ASSESS"*** portion of the Model EHS management system includes the following three elements (expectations for each element are included in the appropriate box):

10. EHS Performance Monitoring & Measurement

- Key performance indicators identified & recorded
- Monitoring equipment calibrated, maintained and recorded
- Performance routinely measured, evaluated, reviewed & communicated

11. Incident Investigation, Reporting & Analysis

- Incidents reported, investigated, analyzed & documented
- Investigations conducted to identify causes & contributing factors, & corrective or preventative actions
- Findings analyzed for continual system improvements
- Corrective actions verified & documented
- Lessons learned communicated

12. EHS Management System Audit

- Employees involved in audit development process & self-audits
- Audit procedures in place to determine system conformance
- Periodic audits are prioritized based on risks & prior performance
- Audits reflect operational complexities
- Findings analyzed, documented, corrected & communicated
- Audits by multi-disciplinary teams & reviews by local & corporate management

Monitoring EHS performance and stewardship involves quantifying changes or trends in performance improvement (e.g., fewer emissions, accidents, spills; improved interested party communications; etc.). After quantifying the changes and trends in performance, an organization can identify economic and social benefits, both internal and external, resulting from

these activities. It is the monitoring of EHS performance that gives the organization the capability, "the facts," to demonstrate the quality and degree of improvement of its performance, and consequently, the quality of its environmental stewardship.

The objectives of measurement and verification are to ensure: (1) that processes exist to measure performance against objectives and expected results, and (2) that proper functioning of the system is verified.

Processes need to be set up to measure system performance against the objectives and expected results. Measurement is a means to check system performance against requirements or expectations. Specific system outputs need to be measured to ensure that the system is functioning and meeting its objectives. Auditing the EHS Management System involves monitoring and assessing system effectiveness and efficiency parameters.

The purpose of system verification is to confirm that the system is continuously functioning and meeting its objectives. Verification is usually done through some form of review of the system or system outputs. Verification includes both management review of the system and field verification to ensure the system is working as designed in an operation.

1.2.4 *Feedback Mechanism* [ADJUST]

The final or ***"ADJUST"*** portion of the Model EHS management system includes one element (expectations of this element are included in the box below):

13. Management Review & Adjustment

- Audit results periodically reviewed with management to assess EHS management system effectiveness
- Findings documented & reported to management to make necessary improvements
- System in place to ensure resolution of findings

The purpose of a feedback mechanism is to improve the system's effectiveness and quality based on measurement and verification findings, and to follow up on findings from the review. Timing and designated responsibilities should be included in follow-up actions.

2.0 IMPLEMENTING AN EHS MANAGEMENT SYSTEM

For effective implementation, a company should develop the capabilities and support mechanisms necessary to achieve its EHS policies, objectives and targets. This section identifies specific aspects of operating and supporting an EHS management system that can help achieve successful implementation. A gap analysis, which may be useful when creating or assessing implementation of an EHS Management System, is provided in Appendix D.

2.1 General

The capabilities and support required by a company constantly evolve in response to changing external requirements and progress made as part of the process of continuous improvement. Periodic review and realignment of people, systems, strategy, resources and structure are required for a company to achieve its EHS objectives.

For many companies, EHS management systems can be implemented in stages -- based on requirements, expected benefits and available resources.

2.2 Ensuring Capability

2.2.1 *Resources*

Appropriate human, physical and financial resources should be defined and made available to permit a company to implement its EHS policies and achieve its objectives. A mechanism should exist for tracking the costs and benefits of EHS activities.

> **Practical Help - Resources**
>
> Leverage resources wherever possible by considering cooperative strategies with other companies, such as customers or suppliers, trade associations, government, standardization organizations, or the academic community.
> These cooperative strategies can address technology development, innovation, communications, training, shared facilities and costs.
> Mechanisms should be in place to budget resources for the EHS management system and to track its costs and benefits.

2.2.2 *EHS Management System Alignment and Integration*

To effectively manage EHS concerns, EHS management system elements should be aligned and integrated with existing management system elements. Periodic review of the degree of integration and the process for balancing and resolving conflicts between EHS and other business objectives and priorities should occur. Risk assessments are valuable tools that can provide qualitative and quantitative information to assist in prioritizing actions. There are numerous generally-accepted tools and standards that provide guidance on how to think about and do risk assessments.

Practical Help - Integration

Business system elements that can benefit from integration include policies, resource allocation, operational controls and documentation, information and support systems, training and development, organization and accountability structure, reward and appraisal, measuring and monitoring, and communications and reporting.

2.2.3 *Accountability and Responsibility*

Responsibility for the effectiveness of the EHS management system should be assigned to senior persons or functions with sufficient authority, competence and resources to implement the system.

Operational managers should clearly define the responsibilities of relevant personnel and be responsible and accountable for effective implementation of the EHS management system and EHS performance.

Employees at all levels should be accountable, within the scope of their responsibilities, for EHS performance in support of the overall system.

Practical Help - Accountability and Responsibility

One possible approach for developing EHS management system responsibilities is shown below:

Sample responsibilities:	*Typical responsible person*:
Establish overall direction	President, CEO, Board of Directors
Develop EHS policy	President, CEO, Chief EHS manager
Develop objectives, targets and programs	Relevant managers
Monitor overall EHS performance	Chief EHS manager
Assure regulatory compliance	Senior operating manager
Ensure continual improvement	All employees
Identify customer expectations	Sales and marketing staff
Identify suppliers expectations	Purchasers, buyers
Develop and maintain accounting procedures	Finance/accounting managers
Comply with defined procedures	All employees

2.2.4 *Awareness and Motivation*

Top management has a key role to play in building awareness and motivating employees. By establishing and explaining the organization's EHS values and communicating its commitment to the EHS policy, management can demonstrate the importance of integrating the EHS management system into the working culture of the organization. The commitment of individual people, in the context of shared values, makes an EHS management system an effective process.

All employees should understand and be encouraged to accept the importance of achieving the EHS objectives and targets for which they are responsible and/or accountable. They should, in turn, encourage fellow employees to respond in a similar manner.

Recognition and rewards can be used to motivate continual improvement and achievement of EHS objectives and targets.

2.2.5 *Knowledge, Skills and Training*

The knowledge and skills necessary to achieve company EHS objectives should be identified. These should be considered in personnel selection, recruitment, training, development of skills and ongoing education.

The company should also require that contractors working at its facilities or performing work for the company at their facilities provide evidence that they have the requisite EHS knowledge and skills to perform the work responsibly.

Education and training are needed to ensure employees have appropriate and current knowledge of regulatory requirements, internal standards and the company's policies and objectives.

Training programs typically include identification of needs, development of plans to address needs, verification of conformance to requirements, training, documentation and evaluation. Types of training that can be provided include raising awareness of the strategic importance of sound EHS management, raising awareness of EHS issues, regulatory compliance requirements, and enhancing skills.

2.3 Support Action

2.3.1 *Communication and Reporting*

Appropriate communication serves to motivate employees and encourage public understanding and acceptance of the organization's efforts to improve its EHS performance.

Communication includes reporting internally and, as appropriate, externally on the EHS activities of the organization to demonstrate commitment; raise awareness; deal with concerns about company/facility activities, products or services; and provide information about the EHS management system and performance.

Results of EHS management system monitoring, audit and review need to be provided to employees responsible for performance.

Practical Help - Communication and Reporting

The Public Environmental Reporting Initiative (PERI) guidelines provide a balanced, flexible framework for a company to report its EHS policies and performance internally or externally. A copy of these guidelines can be obtained from a Web site maintained by IBM™:

http://www.ibm.com/ibm/Environment/annual97/preface.html#PERI

For both internal and external communication and reporting, two-way communication should be encouraged; information should be understandable, verifiable, adequately explained, presented in a consistent form; and should provide an accurate picture of company EHS performance.

2.3.2 *Documentation*

The existence of EHS management system documentation supports employee awareness of what is required to achieve the organization's environmental objectives and enables the evaluation of the system and environmental performance.

Operational processes and procedures should be defined and appropriately documented. The various types of documents that specify effective EHS management system operational procedures and controls should be defined, distributed as appropriate, controlled, and kept up to date.

2.3.3 *Operational Control*

Implementation is accomplished through operational procedures and controls to ensure EHS policies, objectives and targets can be met.

Practical Help - Operational Control

Consider all company operations and activities that may have significant EHS impacts when developing operational controls and procedures. These operations and activities may include: R&D, design and engineering; purchasing, contracting, handling and storage; production, maintenance, testing, transportation, marketing, advertising, customer service; and acquisition, construction, or modification of property and facilities.

2.3.4 *Emergency Preparedness and Response*

Plans and procedures should be established to ensure appropriate response to unexpected incidents due to abnormal operating conditions, accidents and other potential emergency situations. Where appropriate, plans should address immediate and long-term injuries to people, either on-site or off-site; damage to equipment; accidental chemical releases to air, water or land; and specific environmental or ecosystem effects from accidental releases.

Practical Help - Emergency Plans

Emergency plans typically include emergency organization and responsibilities; a list of key personnel and how to reach them; a list of emergency services and how to reach them; internal and external communication plans; actions to be taken in the event of different types of emergencies; information on hazardous materials; training plans; and a schedule for testing the effectiveness of the plan by conducting drills.

2.4 Measurement and Evaluation

Measuring, monitoring and evaluating are key activities of a complete EHS management system. They ensure that the company/facility is performing in accordance with the stated EHS management program, including its EHS policies, objectives and targets.

2.4.1 *Measuring and Monitoring*

There should be a system in place for reliably measuring and monitoring actual performance against the company's EHS management system and operational targets. The results should be analyzed and used to determine areas of success, and to identify activities requiring improvement.

Identifying performance indicators should be an ongoing process. Such indicators need to be objective, verifiable, reproducible, practical, cost-effective and, above all, relevant to the business or operations using the EHS management system.

2.4.2 *Corrective and Preventive Action*

Findings, conclusions and recommendation reached as a result of measuring, monitoring, audits and other reviews of the EHS management system should be documented, and the necessary corrective and preventive actions identified. Management should ensure that these actions are implemented and that there is systematic follow-up to ensure their effectiveness.

2.4.3 *Records and Information Management*

Evidence of the ongoing operation of the EHS management system should be collected and effectively managed. Retention of documents will conform to regulatory and company requirements.

2.4.4 *EHS Management System Audits*

Objective and impartial audits should be conducted on a periodic basis to determine whether the system conforms to planned arrangements and has been properly implemented and maintained. Appropriately trained personnel, from inside or outside the company, should be used to carry out the audits. Audit frequency should be established according to the nature of the operation, potential EHS impacts, and results of previous audits.

2.5 Review and Improvement

An EHS management system should be part of a continual improvement process to achieve better EHS performance.

2.5.1 *Management System Review*

Periodic reviews of the EHS management system should be conducted to ensure its continuing suitability and effectiveness. The review should address the EHS dimensions of all activities, products or services produced by the organization. Involvement of appropriate employees and the views of interested parties should be considered in the review.

2.5.2 *Continual Improvement*

The concept of continual improvement is embodied in the EHS management system. It is achieved by periodically evaluating the environmental performance of the company/facility against its environmental policies, objectives and targets for the purpose of identifying opportunities for improvement of the system.

3.0 ASSESSMENT OR AUDIT OF MANAGEMENT SYSTEMS

3.1 Overview

In assessing or auditing EHS management systems, the first step is to examine system documentation to determine the extent to which each element of the management system has been implemented. One approach is to assess the "status" and the "effectiveness" of each element. Assessing the status and effectiveness of each element against the four management system characteristics may be helpful in determining the adequacy of the entire system and its elements.

Adequate system design alone does not control the risks in an operation. The actual application of the system must be tested. The following section elaborates on the status and effectiveness dimensions necessary for a good EHS management system. Evaluation of these dimensions is key to judging the quality or suitability of a system in use in an operation.

Assessing system effectiveness against what is appropriate in an operation is a judgmental exercise and requires an experienced assessor. Learning occurs both within the assessment team, and in the assessed organizational unit.

3.2 Status

The status of a system element is a measure of the stage of system development and implementation within an operation. For example, one approach to measuring system status is to consider four stages:

Stage 1 = *System element under development*

In the early stages, a formal system is being developed to improve the overall management of a related group of activities.

Stage 2 = *System element documented, approved, resources provided, and being implemented*

In the next stage, the system element is introduced into the operation. The system element is documented, approved, resources are provided for its implementation, and implementation is underway.

Stage 3 = *System element functioning and being verified, results being measured, system procedures documented*

In this stage, the system element is functioning in the organization. Adjustments to the documented system element's process steps, if necessary, have been made for completeness and to ensure the system element functions as intended. Ongoing verification measures indicate that it is working as designed. Procedures are documented, and results or outputs are being measured.

Stage 4 = *System element sustained and supported by ongoing, continual improvement process*

The fourth stage signifies a fully mature system. Resources are in place to sustain the system element and the system has undergone at least one feedback, review and improvement cycle. It is important to note that at this stage, a continual improvement process is in place to identify and execute improvements to the system. The continual improvement loop is required to sustain the system over time. It ensures that the system continues to operate effectively with organizational and operational changes.

3.3 Effectiveness

The second dimension used to describe the application of a system element is effectiveness. System documentation describes the scope of activities or operations, risks to be managed and expected results. The activities/operations, risks and expected results are called "system objectives." The effectiveness dimension is a measure of the extent to which these system objectives are met.

3.3.1 *Quality*

Overall quality of a system element must be evaluated as part of the effectiveness dimension. Quality is defined here as the "suitability of a system element to its intended purpose and its conformance to specifications." A judgment of a system element's suitability is necessary.

One question to ask to determine suitability is: "Does the system align with the relative risk of an operation or activity and the organization that uses it?"

- *For example, a system element that is too complex, or requires too many resources for an organization to implement in a practical way, would not be a functional system and is of questionable quality.*
- *A system element that requires personnel to perform a task before they are trained to perform it (e.g., identifying hazards) would not be an effective system.*
- *A system element that was implemented by a large task force and requires the task force to satisfy all the expectations of the element would not be sustainable when the task force is disbanded.*

Some factors that could be considered in evaluating system quality and suitability include:

3.3.1.1 Timeliness

- Are system outputs produced and acted upon in a timely manner?
- Are deviations or exceptions to expected results handled in a timely fashion?
- Is verification conducted at regular and appropriate intervals?
- Is backlog of system outputs at an appropriate level?

3.3.1.2 Alignment

- Have system responsibilities and objectives been communicated, understood and accepted by those involved with the system's implementation?
- Is the system being used consistently?

3.3.1.3 Resource Adequacy

- Have appropriate resources been allocated and assigned to implement and sustain the system?
- Has sufficient training been conducted for those involved with the system?

3.3.1.4 Adequacy of Outputs

- Is appropriate emphasis placed on higher-risk activities?
- Is information generated by the system pertinent, accurate and thorough?
- Are system outputs presented in a readily understood (i.e., user friendly) manner?

The following analogy may be helpful in illustrating the status and effectiveness dimensions.

> *Using an umbrella as the analogy, the status dimension would be having (or not having) the umbrella in hand when it starts raining. The effectiveness dimension would be how far the umbrella is opened and how well it keeps you dry. An umbrella that is only partially opened or that leaks, would not keep you dry; and, therefore, would have a low effectiveness.*

Assessing system effectiveness against what is appropriate in an operation is a judgmental exercise and requires an experienced assessor.

3.3.2 *Categories of System Effectiveness*

One approach to measuring system effectiveness is to consider four stages of increasing levels of completeness, as follows:

Stage 1 = *System element objectives are being addressed*

A system element will normally satisfy priority objectives and other secondary objectives. If priority objectives are being addressed, but are not yet satisfied, the lowest level of system effectiveness is indicated.

Stage 2 = *System element objectives are satisfied, and majority of other objectives are being addressed*

If priority objectives are satisfied and a majority of the other expectations are only being addressed, the second level of effectiveness is indicated.

Stage 3 = *System element objectives and most other objectives are satisfied*

When all priority objectives and most other objectives are satisfied, the third level is indicated.

Stage 4 = *Essentially all system element objectives are satisfied*

The fourth and highest level is indicated when essentially all objectives are satisfied.

An example of how this might be applied to a work permit system is as follows:

For purposes of this discussion, consider a work permit procedure as part of a system element that is intended to control performance of higher-risk work. At a particular location, hot work is performed quite often, and other types of higher-risk work are performed only occasionally. If the system element at this location is designed to cover permitting of only hot work, the system could be satisfying the primary objective but not other objectives (such as confined space entry, excavations, etc.) that also may be of higher risk but are rarely performed. In this case, the system would fall into the second level of effectiveness.

3.4 System Element Assessment

The assessment for each element within a management system includes evaluation of implementation status and system effectiveness. To make this assessment, the stages of the element status and element effectiveness must first be assessed individually, and then in combination. The following table outlines the two dimensions to consider.

Level	Element Status	Element Effectiveness
4	System sustained and supported by an ongoing improvement process.	Essentially all system objectives are satisfied.
3	System functioning and being verified; results being Measured; key system procedures documented.	Priority objectives and most other objectives are satisfied.
2	System documented, approved; resources allocated; and system being implemented.	Priority objectives are satisfied and majority of other objectives are being addressed.
1	System under development.	Priority objectives are being addressed.

One approach for determining the combined system assessment level is to choose the lower of either the element status or element-effectiveness levels. For example, if Element Status Level = 2, and Element Effectiveness Level = 3; then, the Combined Assessment Level = 2.

It is important to note that overall element assessment requires judgment and experience. Learning occurs both within the assessment team, and in the assessed organizational unit.

3.5 Overall Management System Assessment

Once the status and effectiveness of each element has been analyzed, the entire management system should be assessed. One suggested process for assessing the overall EHS management system involves the following steps:

Step 1 = *Assess system design and implementation status against four characteristics*

In reviewing system design, the system is evaluated for completeness against the four basic system characteristics (i.e., scope and objectives [PLAN]; documented procedures, and responsible and accountable resources [DO]; measurement and verification [ASSESS]; and feedback mechanism [ADJUST] (refer back to Section 1.2). The implementation status of the system elements (Section 3.2) is also evaluated.

Step 2 = *Assess system effectiveness*

In this step, effectiveness of the system elements (Section 3.3) is evaluated based on the actual application of the system.

Step 3 = *Identify areas for improvement or gaps*

This step provides feedback to the assessed unit or organization for improvement of their system. Improvement areas for systems already in place, and the gaps between actual system effectiveness and system expectations are identified. Depending upon the assessment protocol, recommendations for identified improvements and gaps may be provided.

Step 4 = *Determine relative priority or gaps*

Analyze status and develop a work plan for each element. Prioritize elements to determine resource needs/availability and work scheduling.

Step 5 = *Determine overall system assessment*

This step involves calculating overall system assessment. One approach is to combine the status and effectiveness dimensions for each element. The lower level of either dimension determines the overall rating level for that system element, and correspondingly, the overall system rating.

3.6 Self-Assessment Examples

The following two examples show how the above process may be implemented.

3.6.1 *Self-Assessment Example #1*

This Environment, Health and Safety (EHS) Self-Assessment process provides a way for business teams to measure implementation of their EHS management system. This self-assessment process is a management tool that invokes dialogues between managers and their direct reports on work practices of importance to the company, and their alignment with the corporation's vision, commitment and policies. This assessment is also used to verify whether the business is meeting requirements of the Federal Sentencing Act Guidelines, i.e., maintaining an effective program to comply with the law.

Self-assessment builds awareness in an organization and facilitates integration of EHS issues into business processes (e.g., planning, financial, projects, etc.). This self-assessment process also provides a way to map an organization's status in the company's strategic management process, and to gauge progress for continual improvement.

For a manager to realistically assess implementation of an EHS management system in a business unit or at a site, it is necessary to evaluate the existence and effectiveness of EHS systems within the business, based on documentation and demonstrated practices, rather than beliefs and supposition.

The following self-assessment form provides a simple checklist of the core elements that must be part of any company EHS management system. The records generated by using this tool will demonstrate the business unit's commitment over time. To demonstrate awareness of the need for an effective EHS management system and legal compliance program, each business unit leader is requested to sign the response to the self-assessment.

The table below shows a sample set of management practices "filled out" for Management Leadership, Responsibilities & Accountability. The status of this organization's safety (S), occupational health (H) and environmental (E) management practices in each of the listed categories is shown. By comparing the previous year's responses, a record of progress is maintained.

"Self-assessment" is not an audit of performance.

SCOPE AND OBJECTIVES [PLAN] COMPONENTS

Evaluation Categories	**NA**	**DK**	**EP**	**DP**	**IP**	**CI***
Management Leadership, Responsibilities & Accountability						
Policies established & communicated				H	E	S
Management active & visible at all levels			E	H	S	
Operations management sets scope			S	E	H	
EHS responsibilities clearly defined				S H	E	
EHS performance recognized and included in appraisal process				H S	E	
Employees actively involved					SHE	
Goals & objectives set & communicated					SHE	

*NA = Not Applicable
DK = Don't Know
EP = Evaluating Practice
DP = Developing Practice or Program
IP = Implementing Practice or Program
CI = Continual Improvement of Practice in Place

3.6.2 *Self-Assessment Example #2*

Instructions for Performing an EHS Self-Assessment

1. Become familiar with the self-assessment forms, which are available for each element of the EHS Management System (EHS MS). The forms consolidate information needed to perform and document results of a self-assessment.

2. Assemble an assessment team that includes decisionmakers for the business unit or function, and the environmental, health and safety support groups (e.g., a refinery manager, area managers, and EHS media leads).

3. With the assembled team, consider the application of the EHS Management System to the business unit or function by reviewing the EHS MS document, self-assessment forms, and business unit strategic plans.

4. Conduct an "as-is" assessment for each element of the EHS MS by comparing business unit/function practices or conditions to the descriptions listed on the EHS MS self-assessment forms.

   A. Begin at Level 1, Awareness Building, and move up the chart to identify and highlight the descriptors that have been achieved. This should be an interactive, consensus-building process that results in discussion of the processes currently in place. It may be necessary to review existing documents and programs to affirm that certain levels actually have been achieved.

   B. Determine the level of current performance by noting the level at which all the descriptors are met (i.e., to achieve Level 3 -- all descriptors of Levels 1, 2, and 3 must be met). Indicate the appropriate level for the current year in the space provided on the form.

5. Discuss with the group and set the priority of this EHS MS element relative to other business unit needs. Indicate the appropriate level, High, Medium or Low, on the form.

6. For all EHS MS Elements rated "High"

   A. Using the chart provided on the form as a guide, the group should examine the descriptors in the levels higher than the current level, and determine where they want/need to make progress over the next 1 to 3 years to reach the higher level.

   B. Develop gap closure plans and assign resources. Include the gap closure plans in the Personal Goals for both the managers and assigned resources. Document in summary form the "Action Items for Next Year," and list Task Assignments on the form.

7. Retain completed forms as documentation of the self-analysis. Measure and track action items to closure.

8. Manage environmental, health and safety performance as part of the Business Plan.

Sample Form for Self-Assessment Example #2:

Section 3.0 Company X's EHS Policy statement on Goals and Objectives

Systematically manage environmental, health and safety performance by:
Developing aligned goals and standards, and ensuring responsibilities are assigned and understood.

Continual Improvement (4) • Environmental goal-setting and periodic progress reviews are an integral part of the annual business goal setting process. • Environmental goals and targets set annually and aligned with business strategies. • Business Unit and employees, goals integrated and supported by rewards and compensation system.
Implementation (3) • Business and EHS staff jointly develop EHS goals and plans for business groups. • Business Unit goals known and understood by employees and contractors/suppliers. • Management and employees have individual goals that drive improved EHS performance.
Development (2) • EHS goals set by EHS group. • Business Unit goals communicated to organization. • Managers and supervisors have EHS performance goals.
Awareness Building (1) • Organization has EHS goals.

Performance Assessment	Previous Year	Current Year	Target for Next Year

Implementation Priority Relative to Overall Business Unit Needs:	High	Medium	Low

Action Items for Next Year:

Task Assignments and Due Dates:

BU/Function:	**Date Updated:**	**Updated By:**

4.0 GLOSSARY

Term	Definition
Assessment or Audit:	A systematic review of the design, status and effectiveness of a management system.
Continual improvement:	The process of enhancing the management system to achieve improvements in overall EHS performance in line with the organization's EHS policy and performance objectives.
Contractor:	An individual, partnership, firm or corporation retained by the owner or operator to perform work or provide service, supplies or equipment.
EHS Management System (EHS MS):	A continual improvement process that applies a quality systems approach to managing EHS activities to achieve compliance and other planned objectives.
EHS MS Audit:	A means to assess that the organization's continual improvement process for managing environmental, health and safety activities is functioning properly and achieving its objectives.
Element:	A key component of a safe, healthy and environmentally-sound operation. The API Model EHS Management System has 13 elements.
Expectation:	A provision or requirement that specifies actions that should be undertaken to meet the management system objectives. There are several expectations for each element of the EHS Management System.
Goals:	General directions or results sought through application of an organization's strategies, objectives and systems.
Objective:	A desired endpoint that helps achieve compliance with the organization's policies, or otherwise improves performance.
Organization:	Generic term used to describe the entirety of a corporation or a company, division, operating unit, business unit, or other similar component of a corporation.
Performance:	A quantifiable level of activity or results achieved.
Policy:	A statement by the organization of its intentions and principles in relation to its overall EHS performance, which provides a framework for action and for setting EHS objectives and targets.
Practice:	Methods or means of accomplishing stated tasks.

Procedure:	A step or series of steps to be carried out in logical order in a given situation.
Process:	A series of actions, changes or functions that bring about an end or result.
Program:	A plan of action that includes scheduled events or activities.
Quality:	Suitability of a system to its intended purpose and its conformance to specifications.
Sector:	An operational division within a corporation or company, e.g., exploration and production, refining, terminals, pipelines, marine transportation, marketing.
System:	A series of steps taken to ensure that stated objectives are achieved. A typical system includes consideration of four key characteristics: scope and objectives, documented procedures resources for implementation and execution, a verification or measurement process to determine if results are being achieved, and a feedback mechanism to provide for continual improvement.
System Effectiveness:	Extent to which system objectives are satisfied, including the overall quality of the EHS Management System.
System Status:	The measure or stage of development and implementation of an individual system at time of assessment.
Targets:	Milestones that must be achieved, or actions completed, within a specified time to meet an objective.
Verification:	Procedure by which validity is determined. In respect to systems, it is the procedure for determining validity against the system's design.

Section 5.0 – APPENDIXES

APPENDIX A - INDUSTRY CODES, PRACTICES AND STANDARDS

Management Leadership, Responsibilities & Accountability

API RP 9000 *Management Practices, Self-Assessment Process, and Resource Materials*

Risk Assessment & Management

API RP 75 Recommended Practices for Development of a Safety and Environmental Management Program for Outer Continental Shelf (OCS) Operations and Facilities
API RP 750 *Management of Process Hazards*
API RP 752 *Management of Hazards Associated with Location of Process Plant Buildings*
API RP 2003 *Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents*
API Publ 2009 *Safe Welding and Cutting Practices in Refineries, Gasoline Plants, and Petrochemical Plants*
API Std 2015 *Safe Entry and Cleaning of Petroleum Storage Tanks, Planning and Managing Tank Entry from Decommissioning Through Recommissioning*
API Publ 2201 *Procedures for Welding or Hot Tapping on Equipment in Service*
API Publ 422 *Groundwater Protection Programs for Petroleum Refining and Storage Facilities: A Guidance Document*

Personnel, Training & Third-Party Services

API RP 2220 *Improving Owner and Contractor Safety Performance*
API RP 2221 *API/CMA Manager's Guide to Implementing a Contractor Safety Program*
API Publ1200 *Federally Mandated Training and Information*
API Publ1200E *Electronic Curriculums Manager for Federally Mandated Training and Information*
API Publ1210 *Trainer Competencies*
PILOT for Windows: *Hearing Protection;*
Respiratory Protection;
Portable Fire Extinguishers;
Confined Space Entry;
Hazard Communication;
Benzene;
Hazardous Waste Operations and Emergency Response;
Eye and Face Protection; and
Control of Hazardous Energy (Lockout/Tagout)

Facilities Design & Construction

Inspection of Refinery Equipment
API Std 510 *Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair and Alteration*
API Std 570 *Piping Inspection Code: Inspection, Repair, Alteration, And Rerating of In-Service Piping Systems*
API Std 653 *Tank Inspection, Repair, Alteration, and Reconstruction*
API RP 572 *Inspection of Pressure Vessels*

API RP 573 *Inspection of Fired Boilers and Heaters*
API RP 574 *Inspection of Piping, Tubing, Valves, and Fittings*

API RP 575 *Inspection of Atmospheric and Low-Pressure Storage Tanks*
API RP 576 *Inspection of Pressure Relieving Devices*
API Publ 581 *Base Resource Document -- Risk-Based Inspection*

Heat Transfer Equipment Standards for Refinery Service
API Std 530 *Calculation of Heater Tube Thickness in Petroleum Refineries*
API Std 534 *Heat Recovery Steam Generators*
API Std 535 *Burners for Fired Heaters in General Refinery Service*
API Std 560 *Fired Heaters for General Refinery Service*
API Std 660 *Shell-and-Tube Heat Exchangers for General Refinery Services*
API Std 661 *Air-Cooled Heat Exchangers for General Refinery Service*
API Std 662 *Plate Heat Exchangers for General Refinery Services*
API RP 531M *Measurement of Noise from Fired Process Heaters (Metric Only)*

Instrumentation and Control Manuals for Refinery Service
API Std 555 *Process Analyzers*
API RP 551 *Process Measurement Instrumentation*
API RP 552 *Transmission Systems*
API RP 554 *Process Instrumentation and Control*

Mechanical Equipment Standards for Refinery Service
API Std 610 *Centrifugal Pumps for Petroleum, Heavy Duty Chemical, and Gas Industry Services*
API Std 611 *General-Purpose Steam Turbines for Refinery Service*
API Std 612 *Special Purpose Steam Turbines for Petroleum, Chemical, and Gas Industry Services*
API Std 613 *Special-Purpose Gear Units for Petroleum, Chemical, and Gas Industry Services*
API Std 614 *Lubrication, Shaft-Sealing, and Control-Oil Systems for Special-Purpose Applications*
API Std 616 *Gas Turbines for Refinery Services*
API Std 617 *Centrifugal Compressors for Petroleum, Chemical, and Gas Service Industries*
API Std 618 *Reciprocating compressors for Petroleum, Chemical, and Gas Industry Services*
API Std 619 *Rotary-Type Positive Displacement Compressors for General Refinery Services*
API Std 670 *Vibration, Axial-Position, and Bearing-Temperature Monitoring Systems*
API Std 671 *Special-Purpose Couplings for Refinery Service*
API Std 672 *Packaged, Integrally Geared Centrifugal Air Compressors for Petroleum, Chemical, and Gas Industry Services*
API Std 674 *Positive Displacement Pumps -- Reciprocating*
API Std 675 *Positive Displacement Pumps -- Controlled Volume*
API Std 676 *Positive Displacement Pumps -- Rotary*
API Std 677 *General-Purpose Gear Units for Refinery Service*
API Std 681 *Liquid Ring Vacuum Pumps and Compressors for Petroleum, Chemical and Gas Industry Services*
API Std 682 *Shaft-Sealing Systems for Centrifugal and Rotary Pumps*
API RP 683 *Quality Improvement Manual for Mechanical Equipment in Petroleum, Chemical, and Gas Industries*
API RP 686 *Machinery Installation and Installation Design*
API Publ 684 *Tutorial on the API Standard Paragraphs Covering Rotor Dynamics and Balance*

Piping Component Standards for Refinery Service

API Std 589 *Fire Test for Evaluation of Valve Stem Packing*
API Std 590 *Steel Line Blanks*

API Std 594 *Wafer and Wafer-Lug Check Valves*
API Std 598 *Valve Inspection and Testing*
API Std 599 *Metal Plug Valves -- Flanged and Welding Ends*
API Std 600 *Steel Gate Valves -- Flanged and Butt-Welding Ends*
API Std 602 *Compact Steel Gate Valves*
API Std 603 *Class 150, Cast, Corrosion-Resistant, Flanged-End Gate Valves*
API Std 607 *Fire Test for Soft-Seated Quarter-Turn Valves*
API Std 608 *Metal Ball Valves -- Flanged and Butt-Welding Ends*
API Std 609 *Lug- and Wafer-Type Butterfly Valves*
API RP 591 *User Acceptance of Refinery Valves*

Pressure-Relieving Systems for Refinery Service

API Std 526 *Flanged Steel Pressure Relief Valves*
API Std 527 *Seat Tightness of Pressure Relief Valves*
API Std 2000 *Venting Atmospheric and Low-Pressure Storage Tanks: Nonrefrigerated and Refrigerated*
API RP 520 *Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries*
API RP 521 *Guide for Pressure-Relieving and Depressuring Systems*

Electrical Installations and Equipment

API Std 541 *Form-Wound Squirrel Cage Induction Motors -- 250 Horsepower and Larger*
API Std 546 *Form-Wound Brushless Synchronous Motors -- 500 Horsepower and Larger*
API RP 500 *Classification of Locations for Electrical Installations at Petroleum Facilities*
API RP 540 *Electrical Installations in Petroleum Processing Plants*

Pressure Vessels and Tanks and Materials Engineering

API Std 510 *Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair, and Alteration*
API Std 620 *Design and Construction of Large, Welded, Low-Pressure Storage Tanks*
API Std 650 *Welded Steel Tanks for Oil Storage*
API Std 653 *Tank Inspection, Repair, Alteration, and Reconstruction*
API Std 2510 *Design and Construction of Liquefied Petroleum Gas Installations (LPG)*
API Std 2610 *Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities*
API RP 651 *Cathodic Protection of Aboveground Petroleum Storage Tanks*
API RP 652 *Lining of Aboveground Petroleum Storage Tank Bottoms*
API RP 920 *Prevention of Brittle Fracture of Pressure Vessels*
API RP 936 *Refractory Installation Quality Control Guidelines -- Inspection and Testing Monolithic Refractory Linings and Materials*
API RP 945 *Avoiding Environmental Cracking in Amine Units*
API Publ 937 *Evaluation of Design Criteria for Storage Tanks With Frangible Roof Joints*
API Publ. 941 *Steels for Hydrogen Service at Elevated Temperatures and Pressures In Petroleum Refineries and Petrochemical Plants*

Boilers and Pressure Vessels

API Publ 910 *Digest of State Boiler, Pressure Vessel, Piping, and Aboveground Storage Tank Rules and Regulations*

Materials Engineering Research Publications

API Publ 938 *An Experimental Study of Causes and Repair of Cracking of 1-1/4 Cr-1/2 Mo Steel Equipment*

API Publ 939 *Research Report On Characterization and Monitoring of Cracking in Wet H2S Service*

Community Awareness & Emergency Response

Promoting Partnerships: Cooperation Between the Petroleum Industry and Environmental, Educational and Community Groups

Fire Service Emergency Management Handbook

EHS Performance Monitoring & Measurement

API Publ 4639 *Estimation of Fugitive Emissions from Petroleum Refinery Process Drains*

API Publ 4612 *1993 Study of Refinery Fugitive Emissions from Equipment Leaks*

API Publ 4587 *Remote Sensing Feasibility Study of Refinery Fenceline Emissions*

API Publ 337 *Development of Emission Factors for Leaks in Refinery Components in Heavy Liquid Service*

Operations, Maintenance and Management of Change

API RP 1663 *Operation Underground*

API RP 1604 *Closure of Underground Petroleum Storage Tanks*

API RP 1621 *Bulk Liquid Stock Control at Retail Outlets*

API RP 1626 *Storing and Handling Ethanol and Gasoline-Ethanol Blends at Distribution Terminals and Service Stations*

API RP 1627 *Storage and Handling of Gasoline-Methanol/Cosolvent Blends at Distribution Terminals and Service Stations*

API Publ 1642 *Alcohol, Ethers, and Gasoline-Alcohol and Gasoline Ether Blends*

API Publ 1659 *Keeping it Clean: Making Safe and Spill-Free Motor Fuel Deliveries* -- video

API RP 2005 *Service Station Safety*

API Std 2610 *Design, Construction, Operation, Maintenance, and Inspection of Terminals and Tank Facilities*

API RP 1112 *Developing a Highway Emergency Response Plan for Incidents Involving Hazardous Materials*

Incident Investigation, Reporting and Analysis

API Publ 1628 *Guide to the Assessment and Remediation of Underground Petroleum Releases (Natural Attenuation Processes, Risk-Based Decision Making, Optimization of Hydrocarbon Recovery, In-Situ Air Sparging, & Operation and Maintenance Consideration for Hydrocarbon Remediation Systems)*

API Publ 1629 *Guide for Assessing and Remediating Petroleum Hydrocarbons in Soils*

API Video *For Safety's Sake -- MC Cargo Tank Vehicle Inspection*

APPENDIX B - GOVERNMENT CODES, RULES AND REGULATIONS

Implications of the following list of EHS regulatory topics may need to be considered during development and implementation of an EHS Management System:

Aboveground storage tanks
Army Corps of Engineers
- Dredge and fill
- Wetlands, etc.

Bureau of Land Management
Clean Air Act
- Permitting
- New Source Performance Standards
- National Emissions Standards for Hazardous Air Pollutants
- State/local requirements (e.g., VOC sources, RFG, emissions inventories, etc.)
- Mobile sources
- Fuel issues
- Stack heights
- Risk Management Plan
- Etc.

Clean Water Act
- NPDES (e.g., permits, monitoring, reports, etc.)
- Stormwater
- Drinking water (e.g., monitoring, sampling, etc.)
- Underground injection control (e.g., permits, monitoring, record keeping, etc.)
- Groundwater, etc.

Department of Transportation
- HAZMAT incident reporting
- Training
- Pipelines, etc.

Endangered Species Act
FIFRA
Fish and Wildlife Regulations
Minerals Management Service
Oil Pollution Act of 1990
OSHA
- Process Safety Management
- Personal protective equipment
- PELs, etc.

SARA
- Risk Management Plans
- Release reporting
- TRI emissions inventory
- MSDS
- Emergency response plans, etc.

Toxic Substance Control Act
- PCB activities
- Imports of products, etc.

Underground storage tanks
U.S. Coast Guard
- Marine transfer facilities, etc.

Waste
- Resource Conservation and Recovery Act
- Small/large quantity generators
- Manifesting of hazardous waste
- Permitting
- CERCLA/Superfund, etc.

APPENDIX C - REFERENCES AND OTHER USEFUL RESOURCES

The following API environmental, health and safety publications or resource materials may be useful during the development and implementation of EHS management systems. These publications are developed primarily under the direction of the API Safety and Fire Protection Subcommittee and API HESD Department committees and staff.

Policy and Planning

A Compliance Guideline for EPA's Risk Management Program Rule (Available through CMA)
Model Risk Management Plan Guidance for Petroleum Refineries, Complying with EPA's Rule (40 *CFR* 68), [API Publ K76001]

Implementation and Operations

API Publ 4625	*Service Station Personnel Exposure to Oxygenated Fuel Components*
API Publ 4622	*Petroleum Industry Data Characterizing Occupational Exposures to Methyl Tertiary Butyl Ether (MTBE): 1983-1993*
API Publ 4619	*A Study to Characterize Air Concentrations of Methyl Tertiary Butyl Ether (MTBE) at Service Stations in the Northeast*
API Publ 4553	*Gasoline Vapor Exposure Assessment at Service Stations*
API Publ 4634	*Index and Abstracts of API Health-Related Research*
API Publ 4592	*Odor Threshold Studies Performed with Gasoline and Gasoline Combined with MTBE, ETBE, and TAME*
API Publ 45592	*Results of Toxicological Studies Conducted for the American Petroleum Institute Health and Environmental Sciences Department*
API Publ 4555	*A Mortality Study of Marketing and Marine Distribution Workers with Potential Exposure to Gasoline*
API Publ 45551	*A Nested Case-Control Study of Kidney Cancer, Leukemia and Multiple Myeloma in a Cohort of Land-Based Terminal Workers Exposed to Gasoline in the Petroleum Industry*
API Publ 45552	*An Exposure Assessment for Marketing and Marine Distribution Workers in the Petroleum Industry with Potential Exposure to Gasoline*

Community Awareness & Emergency Response

API Publ 4636	*HGSYSTEM 3.0: Technical Reference Manual and User's Guide*
API Publ 4628	*A Guidance Manual for Modeling Hypothetical Accidental Releases to the Atmosphere*
API Publ 4596	*Studies to Determine the Ecological Effects of Cleanup Methods for Oiled Shorelines, Phase 1*
API Publ 4567	*Oil Spill Response in the Freshwater Environment*
API Publ 4558	*Options for Minimizing Environmental Impacts of Freshwater Spill Response*
API Publ 4508	*Petroleum in the Freshwater Environment*

Measurement and Checking

API Publ 332	*Comparison of Screening Values From Selected Hydrocarbon Screening Instruments*
API Publ 4638	*Calculation Workbook for Oil and Gas Production Equipment Fugitive Emissions*
API Publ 4615	*Emission Factors for Oil and Gas Production Operations*
API Publ 4589	*Fugitive Hydrocarbon Emissions from Oil and Gas Production Operations*
API DR 220	*Potential BTEX Emissions From the Nation's Triethylene Glycol Units in Oil and Natural Gas Facilities*
API DR 110	*Estimation of Aromatic Hydrocarbon Emissions from Glycol Dehydration Units Using a Process Simulation Model*
API Publ 4588	*Development of Fugitive Emission Factors and Emission Profiles for Petroleum Marketing Terminals*
API Publ 4639	*Estimation of Fugitive Emissions from Petroleum Refinery Process Drains*
API Publ 4612	*1993 Study of Refinery Fugitive Emissions from Equipment Leaks*
API Publ 4587	*Remote Sensing Feasibility Study of Refinery Fenceline Emissions*
API Publ 337	*Development of Emission Factors for Leaks in Refinery Components in Heavy Liquid Service*
API Publ 335	*Refinery MACT Workshop: October 23-24, 1995 VADSAT: A Vadose and Saturated Zone Transport Model for Assessing the Effects on Groundwater Quality from Subsurface Hydrocarbon Releases and Petroleum Production Waste Management Practices*
API Publ 334	*A Guide to Leak Detection for Aboveground Storage Tanks*
API Publ 328	*Laboratory Evaluation of Candidate Liners for Secondary Containment of Petroleum Products*
API Publ 327	*Aboveground Storage Tank Standards: A Tutorial*
API Publ 325	*An Evaluation of a Methodology for the Detection of Leaks in Aboveground Storage Tanks*
API Publ 323	*An Engineering Evaluation of Volumetric Methods of Leak Detection in Aboveground Storage Tanks*
API Publ 322	*An Engineering Evaluation of Acoustic Methods of Leak Detection in Aboveground Storage Tanks*
API Publ 315	*Assessment of Tankfield Dike Lining Materials and Methods* API Pub. 4608 *User's Guide: Evaluation of Sediment Toxicity Tests for Biomonitoring Programs*
API Publ 4607	*User's Guide and Technical Resource Document: Evaluation of Sediment Toxicity Tests for Biomonitoring Programs*
API Publ 4600	*Metals Criteria for Land Management of Exploration and Production Wastes: Technical Support Document of API Recommended Guidance Values*
API Publ 4595	*Criteria for pH in Onshore Solid Waste Management in Exploration and Production Operations*
API Publ 4527	*Evaluation of Limiting Constituents Suggested for Land Disposal of Exploration and Production Wastes*

APPENDIX D - GAP ANALYSIS

Conducting a gap analysis may be useful when creating a new EHS Management System, as well as when assessing management system implementation. The following are examples of the types of questions that could be asked during a gap analysis. A company or organization may want to tailor these or other questions depending upon the particular sector or scope of their operations.

POLICY & PLANNING *[PLAN]*

1. Management Leadership, Responsibilities & Accountability

- Have we identified the policy for our organization?
- How will management communicate policy (internal & external)?
- How will we demonstrate commitment?
- How will we assure that it is understood by employees/organization (audit process, project review process)?
- Are your roles clearly established in a job description?
- How will we assure employees/contractors are clear about EHS job expectations?
- What process assures us that we have appropriate EHS expertise available to us?
- What process assures that funds will be provided for meeting EHS goals, objectives, and work plans?
- Do you know what you are accountable for in terms of EHS issues?
- Are EHS responsibilities and accountabilities defined (e.g., written document)?

2. Risk Assessment & Management

- How do we identify and plan for significant EHS issues and risks in the business planning process?
- How should we plan?
- Is there an informal/formal procedure in place?

3. Compliance and Other Requirements

- Where will we get the regulations (domestic and international) and how will they be kept up to date?
- Will we provide this function in-house or will we use external resource(s)?
- How will the regulations be communicated (e.g., networks, regulatory alerts, newsletters, compliance advisories)?
- What role will we take in influencing legislation/regulation?
- How will we assure compliance costs are incorporated into budget planning process?

4. EHS Management Planning & Programs

- Who in our organization should have explicit EHS goals and objectives?
- How/when will goals be set?
- What are/should be our current long- and/or short-term EHS goals and objectives?

IMPLEMENTATION & OPERATIONS *[DO]*

5. Personnel, Training & Contractor Services

- Do you know what EHS training you should have, and your employees should have, to appropriately manage these issues?

- If you don't know, who does in your organization?
- What EHS training do you require your contractors to have?
- How would you know that contractors are not adequately trained, and what process corrects the deficiencies?
- What criteria should we use as minimum for contractor selection?
- What process is currently used for contractor selection?
- Who is responsible for this process?
- Who do we want to be responsible?
- What is the process for reporting contractor incidents (i.e., is it in contractual requirements)?
- Who manages this?
- What should our contractor-auditing program look like?
- How often should we evaluate contractor performance?
- What criteria are to be used and who will facilitate the evaluation process?

6. Documentation & Communications

- Where are business standards and operating procedures maintained?
- How often are procedures and standards reviewed for adequacy, and updated as appropriate?
- What EHS regulatory reporting must be done? Where are documents retained?
- What are record retention requirements for your EHS related documents?
- Do you have a written EHS Management System document?
- How will employee concerns be addressed (e.g., Hotline available)? Documented?

7. Facilities Design & Construction

- What process do we use to identify other standards/best practices we will try to follow?
- Do we have any "internal" standards that we follow now?
- Who is, or do we want to be, responsible for managing this process?
- Where will internal standards be kept (e.g., Internet, library)?
- How do we assure that planning for implementation of adopted standards is incorporated into business planning cycle?

8. Operations, Maintenance & Management of Change

- Do we have any operating procedures in place?
- What, if any, operating procedures (e.g., contractor business partner selection procedures) do we need? Now? Tomorrow?
- How do employees/contractors come to understand job expectations for EHS in their daily activities?

9. Community Awareness & Emergency Response

- If a non-government organization (NGO) or citizen approaches us with concerns about a business venture and its environmental effects, what process will be used to address this concern?
- How will it be documented?
- How will we decide when it is appropriate to communicate with external audiences on a proactive basis (i.e., who will be involved, who will be accountable for communication, follow-up, etc.)?
- Have you identified what types of emergencies you could reasonably and in "worst case" situations be called upon to respond?
- What is your plan for response to each situation?

- What should your plan for response be?
- Have you had any emergency response, media, or crisis response training?
- Is it appropriate for your job expectations?
- What level of training for emergency response should employees in your organization have?

MEASUREMENT & CHECKING *[ASSESS]*

10. EHS Performance Monitoring & Measurement

- How do you measure your EHS effectiveness now?
- What would be a good, or the best, way to measure your EHS effectiveness?
- Has your organization discussed appropriate EHS measurements?
- Does your organization have a system to manage the current EHS measurement requirements?

11. Incident Investigation, Reporting and Analysis

- Are we building into contracts the right to perform EHS audits of our joint ventures?
- When should we incorporate a defined EHS audit program into our business process?
- Who will be accountable for assuring an audit program is created and implemented at the "right time?"
- Have you performed to date any EHS "self inspections" around business venture efforts (e.g., effects assessments, training, roles/responsibilities, contractor/business partner selection criteria, etc.)?

12. EHS Management System Audit

- What elements of the system, goals, objectives, plans, work programs, emergency preparedness should be reviewed? How often and by whom?
- Who will be responsible and accountable for assuring the review occurs?

MANAGEMENT REVIEW & CONTINUAL IMPROVEMENT *[ADJUST]*

13. Management Review & Adjustment

- Have you had a review by management of EHS issues?
- What tool(s) will you use to facilitate the process?
- Who will be responsible and accountable for assuring that review deficiencies and recommendations are carried out?

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