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ASSESSMENT OF DOCUMENTATION REQUIREMENTS UNDER DOE 5481.1, SAFETY ANALYSIS AND REVIEW SYSTEM (SARS)

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ABSTRACT

This report assesses the requirements of DOE Order 5481.1, "Safety Analysis and Review System for DOE Operations" (SARS) in regard to maintaining SARS documentation. Under SARS, all pertinent details of the entire safety analysis and review process for each DOE operation are to be traceable from the initial identification of a hazard. This report is intended to provide assistance in identifying the points in the SARS cycle at which documentation is required, what type of documentation is most appropriate, and where it ultimately should be maintained.

CONTENTS

1. INTRODUCTION AND OVERVIEW

The DOE Safety Analysis and Review System (SARS), established by DOE 5481.1, is designed to ensure that DOE operations are subjected to a systematic life cycle evaluation of the safety risks to people, property, and the environment. DOE 5481.1 requires that Assistant Secretaries, heads of Offices, or their designees in the line program organization maintain the permanent DOE file of all pertinent documentation relating to the authorization of each DOE operation. It further stipulates that all pertinent details of the analysis, review, and authorization relative to any DOE operation are to be traceable from the initial identification of a hazard to its elimination or the application of controls necessary to appropriately reduce the risk.

The ASFE Plan for Implementing SARS designates ASFE Deputy Assistant Secretaries and Headquarters (HQ) Program Managers as having responsibility for ensuring that adequate documentation is prepared and maintained on SARS requirements relative to their functions. In addition, the Office of Plans and Technology Assessment (OPTA) is charged with establishing an Executive Secretariat to be responsible for "coordinating the overall review effort, maintaining documentation required by 5481.1, assisting OPTA in planning and scheduling review action, and assisting and preparing evaluation reports." Thus, a number of ASFE organizational entities have responsibility for ensuring that there is adequate documentation on the entire SARS process.

Documentation should be retained for the life of the involved DOE operation and should include information pertaining to:

- the systematic identification of hazards
- the estimation of the likelihood of occurrence of each hazard-related incident
- the estimation of potential consequences
- the identification of measures to eliminate, control, or mitigate hazards
- achievement of compliance with all safety design specifications
- the review and approval processes of SARS
- documented management acceptance of any residual risk associated with the operation
- identification of the funding level necessary to achieve the safety level objective.

Adequate documentation is imperative throughout the entire SARS process. Each time a decision is made in complying with SARS, there needs to be available documentation of the decision and the rationale used to arrive at it. For instance, even a decision that a particular project is not subject to the requirements of SARS needs to be documented.

The aim of this report is to investigate and assess the documentation requirements of SARS. The overall intent is to identify the points in the SARS life cycle at which documentation is needed, as well as what type of documentation is most appropriate and where it ultimately should be maintained. Three options for maintaining the requisite documentation are discussed. Under the first option, the Headquarters Executive Secretariat would have a major responsibility for coordinating the documentation for individual projects being managed by the field offices. Under the second option, responsibility for maintaining all pertinent documentation for low and moderate risk projects would be decentralized to the field. In this case, headquarters would be responsible for maintaining high risk projects' documentation, and would periodically appraise the adequacy of the field offices' documentation processes. Under Option 3. all SARS documentation would be maintained at HQ by the Executive Secretariat. Obviously, this option would be difficult to implement and maintain due to the large volume of SARS documentation for all HQ and field projects.

Thus far, no policy guidance has been provided by FE in regard to SARS documentation requirements. However, AFMA has reviewed a number of safety analysis reports which have been completed for FE in order to evaluate to the extent possible the types of documentation which are appropriate and sufficient under DOE 5481.1.

2. SARS DOCUMENTATION REQUIREMENTS

2.1 INTRODUCTION

This section discusses the types of documentation required throughout the SARS cycle, from the initial determination of SARS applicability to the completion of the project. For safety analysis documents, the contents and format which would afford compliance with DOE 5481.1 are described.

2.2 PRELIMINARY RISK ASSESSMENT

According to the ASFE Draft Guidelines on SARS, a Preliminary Risk Assessment (PRA) is required for all ASFE operations, including new and existing projects, and project modifications. The PRA is to be prepared during the concept phase or, for ongoing projects, as soon as practicable.

The PRA serves several purposes. First, it provides a determination as to whether an operation is administratively excluded from DOE 5481.1 or excluded on technical grounds. Administrative exclusions are: (1) construction related activity; (2) nuclear safety of weapons designs; and (3) operations for which DOE does not assume programmatic responsibility for ES&H. An operation is excluded on technical grounds if its hazards are of a type or magnitude that is routinely encountered and/or accepted by the public. If an operation is neither administratively nor technically excluded, the PRA will delineate the overall risk level of the operation and, thus, the level of safety analysis required and the analysis' budget allocation.

If an operation is determined to be exempt from SARS requirements, a short summary of the determination and the rationale behind it should be prepared, signed by the preparer, and sent along with the PRA to the DOE office with immediate management authority for review. It also must be forwarded to OPIA. These summaries should be concise and specifically describe the characteristics of the operation which are believed to make it exempt. For example, for an operation to be technically excluded, the summary sheet should verify that conditions such as the following apply to the project:

- All operation temperatures are between -20^{o}F and 120^{o}F.
- All speeds of any rotating equipment are less than 4000 rpm.
- All operation pressures are between ambient and 15 psig.

- Atmospheric conditions on and off site are within EPA Air Quality Standards.
- There are no sources of ionizing radiation other than instruments.
- All materials have a NFPA Flammability Rating, a NFPA Reactivity Rating, and a NFPA Health Hazard Rating of 1 or less.

If conditions such as those listed above are not met but it is believed that the types and magnitudes of the operation's hazards are typical of those encountered and accepted by the public, the rationale for such a conclusion should be included.

If a project is not excluded from SARS, the PRA will serve to identify the risk level of the operation, and, thus, the level of detail required in subsequent SARS documents. Table 2-1 delineates the possible risk levels which could apply to an operation.

2.3 SAFETY ANALYSIS AND REVIEW PLANS

According to the ASFE Draft Guidelines on SARS, formal, documented SARS Plans are required for:

- All FE major system acquisitions
- All FE projects which are included in the DOE Program/Project Management system
- New projects or operations for which preliminary risk assessments indicate a low, moderate, or high risk
- Existing projects for which preliminary risk assessments indicate a high risk level and which have been identified as requiring a backfit.

The SARS Plan is intended to identify responsibilities for the various safety tasks, the authority delegated for the performance of those responsibilities, the documentation required by the government to be delivered, and the schedule for performance of the tasks. The Plan explains how the safety analysis process will be undertaken throughout the life of the project. Further, it discusses the methods to be used to identify, evaluate, and resolve safety-related problems throughout the development cycle. All Plans should be reviewed by the FE office with immediate management authority; Plans for high risk operations should additionally be forwarded to OPTA for review.

Table 2-1

GUIDE TO HAZARD SEVERITY

I. HIGH	May cause death or system loss or destruction (including legally enforced shutdown because of major violation of codes, standards, or regulations).
II. MODERATE	May cause severe occupational illnesses or injuries (major lost time); off site illnesses or injuries; major damage to plant or property (on or off site); or violations of environmental regulations which lead to threats of litigation.
III. LOW	Can result in minor illness or injury on site without off site impacts. No code, standard, or regulation violations which could lead to action other than warnings.
IV. NORMAL	No on or off site illness or injury; only minimal on site damage, which does not affect plant performance. No off site code, standard, or regulations violation potential.

One of the major purposes of the SARS Plan is to describe how safety related elements of other activities and of design procedures will be identified. For example, other plans such as the ES&H plan, the OSH plan, and the quality assurance and reliability plan should be cited. The level of detail provided in the SARS Plan will be governed by the operations risk category and factors such as public interest in the project. In general, though, they should follow the format outlined below.

(1) GENERAL. Describe the scope and magnitude of the safety analysis and the criteria and documents which will be used in conducting the safety analysis and review program.

(2) ORGANIZATION OF EFFORT. Describe the organizational placement and manning of the project's safety analysis organizations. Provide charts showing the organizational and functional relationships of the primary safety analysis element, and all related entities (such as quality assurance and reliability). This part of the Plan will also describe the responsibilities and authorities of any prime contractors, associate contractors, or subcontractors and safety working groups.

(3) SAFETY ANALYSIS AND REVIEW MILESTONES. The critical events for the safety analysis and review effort throughout the life cycle of the project will be identified and provided on DOE Form CR 535, "Milestone Schedule and Status Report" (or a contracting office or FE HQ-modified version). The milestones should identify the critical inputs to the safety analysis requirement from other analysis efforts as indicated above, and the feedbacks into the design system at such checkpoints as preliminary design reviews, critical design decision evaluations, and other decision points as indicated in DOE Systems Management Procedures and Regulations. The target dates for initiating safety analysis data into the safety analysis and review system will be specifically identified.

(4) SAFETY CRITERIA. Standards, codes, regulations, and other environment, safety, and health criteria which are to be applied to describing, defining, and evaluating hazardous conditions and to be used in risk assessment will be specified.

(5) HAZARDS CLASSIFICATION. Identify and describe the methods and procedures which will be used to classify hazards.

(6) SAFETY DATA. Specify safety data requirements, including deliverable and non-deliverable data. Describe the process for requiring and using safety and hazard-related data, such as accident reports, and environmental violations. Specify the interrelationship and use of environmental assessment data, maintainability studies, etc.

(7) MANAGEMENT SYSTEMS AND TRAINING. Describe how safety and safety-related training and systems will be developed and incorporated into operational and maintenance procedural handbooks and manuals. Provide information on developing training programs for safe operation and maintenance.

(8) FACILITIES AND SUPPORT REQUIREMENTS. Provide information on how the safety requirements associated with storage, handling, transportation, waste disposal, and related support system interfaces are to be evaluated and considered.

(9) TEST PROGRAMS. Describe detailed plans for including safety evaluations as part of the various checkout and test requirements for the system. Describe procedures for assuring that safety-related results of test operations will be integrated into the design, review, and approval process.

2.4 SAFETY ANALYSIS REPORTS

Formalized safety analysis documents must be developed in order to satisfy the requirements of DOE 5481.1. They are intended to fulfill two functions: (1) summarize results of specific environmental, safety, quality assurance, reliability, or other engineering studies aimed at specific characteristics of systems or subsystems having safety implications; and (2) provide additional specific safety data and analysis.

If safety systems are required in the design of the facility, a Preliminary Safety Analysis Report (PSAR) should be provided at the concept design stage and should contain sufficient data to identify all of the basic safety features required in the design and the criteria applied to them. Where the PRA has not identified the need for specific safety systems in the design and where administrative controls are not required to achieve an adequate level of safety, only a Final Safety Analysis Report (FSAR) would be prepared. This would also be the case with existing projects. The intent of the FSAR is to document the manner in which the commitments made in the PSAR were incorporated into the project. It also provides the detailed analysis of the functioning of systems to demonstrate the provision of an acceptable level of safety.

In general terms, the Safety Analysis Report should include an analysis of process hazards, workplace health hazards, workplace safety hazards, and environmental effects. Throughout the analysis, specifications such as the following need to be documented: failure rate data and sources; conformance with codes and standards; identification of potential hazards; and control measures. Whereas the PSAR is aimed primarily toward the design, the FSAR also discusses items such as organizational responsibility for a given operation, training requirements, and inspection and testing requirements.

Modifications to facilities must be examined to determine if they involve any unreviewed safety questions. Where an FSAR exists, modifications to it should be in the form of additional pages required to update the documents. Where modifications do not impact the existing FSAR, a statement to this effect should be forwarded to the FE Office with immediate management authority for the operation. If the modifications are major, or if no FSAR exists for the operation, the safety analysis process to be followed would be analogous to that for new facilities but would apply only to the modification.

As dictated by DOE 5481.1, the safety analysis information should address the following topics in appropriate detail to the extent applicable:

- description and evaluation of the site
- description of the facility and/or operations
- design criteria for systems, components, and structures
- identification of hazards
- physical design features and administrative controls provided for the prevention and mitigation of potential accidents
- potential accidents including those resulting from natural phenomena
- probability of occurrence and predicted consequences of accidents
- normal and emergency operating procedures to be used
- operational limitations.

The suggested general format for Safety Analysis Reports is as follows:

(1) INTRODUCTION

- Scope
- Summary of Facility and Processes

(2) SUMMARY

- Potential Hazards
- Summary Safety Analysis
- Conclusions

(3) SITE DESCRIPTION

- Site Location
- Environmental Factors

(4) FACILITY AND OPERATIONS DESCRIPTIONS

- General Facility Description
- Operations and Process Description
- Design Criteria

(5) PROTECTION AND SAFETY SYSTEMS

- Safety Systems
  - Detection
  - Prevention
  - Mitigation
- Environmental Protection Systems
- Waste Handling, Storage, and Disposal Systems

(6) SAFETY ANALYSIS

- Safety Analysis Methodology
  - Hazards Analysis
  - Accident Analysis
  - Risk Assessment/Measurement
- Normal and Off-Normal Operation
- Potential Hazard and Energy Sources
  - Natural Phenomena
  - Operational Hazards (e.g., high voltage, toxic materials)
  - Extrinsic Hazards

- Accidents
  - Natural Phenomena-Related Accidents
  - Operational Accidents
  - Extrinsic Accidents
- Disruptive Acts
  - Frequency and Magnitude
  - Disruptive Act Scenarios

(7) OPERATIONAL SAFETY REQUIREMENTS

- Organization
- Personnel Training
- Quality Assurance Programs
- Operational Procedures and Limitations
- ES&H Management
- Waste Management
- Decommissioning Plan
- Security Systems
- Audits and Safety Reviews

Both the PSAR and the FSAR should contain Sections 1 through 6 of the outline; the FSAR, however, will require a greater level of detail in these sections, as well as the addition of Section 7.

In informal safety analysis reviews provided for DOE by AFMA, it has been found that safety analysis reports completed thus far have had, in general, the following weaknesses in regard to documentation:

- Hazards are often equated with equipment failures, the basic assumption being that hazards result only from failures of equipment. Often little or no consideration is given to general occupational hazards such as walkways, ladders, and other typically non-failure situations.

- Inadequate consideration usually is given to environmental hazards.

- Hazards analysis external to FMEA generally is absent. FMEA analysis alone is not sufficient for SARS.

In general, it was found that resolution of the issues raised could require extensive revision of the safety analysis documentation.

2.5 EVALUATION REPORTS

The overall conclusions of an FE safety analysis review panel normally is documented in an evaluation report. The evaluation report should be submitted to the official who will authorize the next stage of the project (e.g., ETC Director, Assistant Secretary for Fossil Energy). The evaluation report should summarize whether the safety analysis was found to be adequate, and will serve as the basis for the written authorization for the operation. The suggested format for evaluation reports, as provided in the Draft FE Guidelines on SARS, is provided below.

(1) SUMMARY. Provide a one or two paragraph description of the operation analyzed. State whether the safety analysis is adequate, and recommend--from a safety viewpoint--whether the project should be authorized.

(2) DESCRIPTION OF SAFETY-CRITICAL ELEMENTS. Summarize safety-critical elements controls provided or proposed. Identify the principal safety areas of concern which have been addressed in the safety analysis. Summarize the design or other control features provided or proposed. State for each the review panel's conclusion as to whether the control features meet the criteria adopted as the basis for the analysis.

(3) ELEMENTS OF THE REVIEW PROCESS. Briefly describe the nature and extent of the review process. List all formal and informal panel review meetings, including date, subject, and pertinent conclusions or recommendations arising from the meeting. List all major communications regarding the safety analysis, along with pertinent results. Include information on any site visits. (If this material is lengthy, it may be provided as an appendix.)

(4) OTHER RELEVANT INFORMATION. Provide any other information which contributed to the review panel's evaluation. This may include cross-reference to previously reviewed similar projects' assessments of accident data in other plans which were not considered in the safety analysis.

(5) CONCLUSIONS AND RECOMMENDATIONS. Furnish a rationale for conclusions about the adequacy of the safety analysis and its definition of any residual risks. Formulate a definitive recommendation for the authorizing official regarding acceptance of the residual risks and authorization from a safety viewpoint.

3. RESPONSIBILITIES FOR MAINTENANCE OF DOCUMENTATION

3.1 INTRODUCTION

As discussed earlier, DOE 5481.1 requires that Assistant Secretaries, heads of Offices, or their designees in the line program organization maintain the permanent DOE file of all pertinent documentation related to the authorization of each DOE operation. The ASFE Plan for Implementing SARS delegates this responsibility to ASFE Deputy Assistant Secretaries and HQ Program Managers. OPTA is assigned responsibility for establishing an Executive Secretariat to maintain the required HQ documentation.

All pertinent details of the entire SARS process for each individual operation are to be traceable from the initial identification of the hazard. For this to be possible, a system must be set up whereby responsibilities in regard to documentation preparation and maintenance are clearly defined.

3.2 ALTERNATIVE DOCUMENTATION SYSTEMS

Table 3-1 provides a summary of the types of formal, written documentation required under SARS. As shown in the chart, the various documents often are forwarded to different organizational entities for review and approval. With a structure such as this, three options are available for the coordination of the applicable documentation. Under Option 1, the documentation could be maintained at the point of review, with overall coordination provided by the Executive Secretariat set up by OPTA. As described in the ASFE SARS Implementation Plan, the Executive Secretariat is charged with the following responsibilities:

- Reviewing at HQ the field review process
- Maintaining the documentation file for OPTA
- Providing assistance to OPTA in planning and scheduling review actions and preparing evaluation reports
- Assisting OPTA in planning and conducting HQ ASFE audits and appraisals of the status of SARS actions and functions throughout FE, at HQ and by field organizations.

In addition to the above, the Executive Secretariat would be responsible for ensuring the coordination of the overall documentation requirements. The Executive Secretariat would require the following: a safety and health staff specialist; an environmental, health, and safety scientist; a safety analysis plan manager; a staff research assistant; and a clerical-stenographer. In the event that Federal Civil Service personnel authorizations are not available, these resources initially could be provided by a technical assistance contractor as specified in the FE SARS Implementation Plan.

Table 3-1

TYPES OF DOCUMENTATION REQUIRED UNDER SARS

DOCUMENTATION TYPE	PREPARER	REVIEWER
Preliminary Risk Assessment	FE staff or technical assistance contractors	• DOE office with immediate management authority
SARS Plan	Contractor of Federal facility	• Low and moderate risk: DOE office with immediate management authority • High risk: DOE office with immediate management authority; copy to Director, OPTA
Safety Analysis Reports	Contractor of FE Staff	• Low risk: FE field office or office with immediate management responsibility • Moderate risk: FE field office or office with immediate management responsibility • High risk: DOE HQ
Evaluation Reports	Unit providing the safety analysis review	• Low and Moderate Risk: Official authorizing next phase of project • High Risk: ASFE
Written Authorization for Operation	ASFE, Field Office Director or other official delegated responsibility	• N/A

In Option 2, the responsibility for documentation of all but high risk projects would be delegated completely to the field. Periodic inspections would be performed by OPTA for the purpose of ensuring that the field documentation systems are adequate. These assessments could be integrated easily into the OSH appraisal program described in "Audit and Appraisal Plan for Occupational Safety and Health Program, Phase I," also prepared by AFMA under this contract.

As shown in Table 3-2, if the decision is made to delegate the major portion of the responsibility for SARS documentation to the field, the Executive Secretariat would be responsible only for maintaining documentation pertaining to high risk projects. Overview of field activities would be provided by OPTA as part of its OSH appraisal system, and the main means of control would be through the budget process. Each field office would be responsible for submitting to OPTA an annual report summarizing SARS activities during the past year, and projections for the next three years. These plans would be used mainly in the budget process for determining requisite SARS funding, but they also would provide a means for OPTA to identify any inconsistencies in field SARS activities (e.g., if a project previously determined in a PRA to be moderate risk is ultimately authorized as a high risk project). Overall, this option would provide HQ with much more flexibility than Option 1, while still allowing periodic overview and appraisal.

Under the third option, the Executive Secretariat could be responsible for maintaining all of the documentation for both HQ and field operations. In light of HQ personnel constraints, as well as the fact that the total documentation required under SARS is extremely voluminous, this latter option likely is not appropriate and would be difficult to maintain.

3.3 CONCLUSIONS

In order to ensure that all documentation is maintained as required under DOE 5481.1, DOE HQ must delineate the respective responsibilities of field organizations and of the Executive Secretariat in a timely manner. In addition, an effort must be begun toward establishing the Executive Secretariat. Review should also be made of DOE Order 1324.1, "Records Disposition" in order to ensure that documentation is maintained in a consistent manner throughout all responsible offices.

Table 3-2

POSSIBLE STRATEGY FOR MAINTAINING SARS DOCUMENTATION

(OPTION 2)

DOCUMENTATION TYPE	FIELD RESPONSIBILITY FOR DOCUMENTATION MAINTENANCE*	EXECUTIVE SECRETARIAT RESPONSIBILITY FOR DOCUMENTATION MAINTENANCE
Preliminary Risk Assessment	X	
SARS Plan		
- Low risk operation	X	
- Moderate risk operation	X	
- High risk operation		X
Safety Analysis Reports		
- Low risk operation	X	
- Moderate risk operation	X	
- High risk operation		X
Evaluation Reports		
- Low risk operation	X	
- Moderate risk operation	X	
- High risk operation		X
Written Authorization		
- Low risk operation	X	
- Moderate risk operation	X	
- High risk operation		X

*The Executive Secretariat would be charged with these responsibilities where ASFE has not delegated project management responsibility to a field office (i.e., in the case of operations managed by HQ).