

LOS ALAMOS NATIONAL LABORATORY SELF-ASSESSMENT OF OLDER SAFETY ANALYSIS REPORTS

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ABSTRACT

As parts of its commitment to the Department of Energy (DOE) in the University of California contract to manage the site, Los Alamos National Laboratory performed a self-assessment of the quality of its older Authorization Basis (AB) documents [Safety Analysis Reports (SARs), Bases for Interim Operations (BIOS), etc.]. Because time would not allow for all facilities to be examined, of the 19 nuclear facilities at the site, the 10 facilities with the oldest documents were examined.

In the review, the AB documents were compared with the current DOE orders and standards. The method used to evaluate the documents included such things as (1) the acceptance criteria for AB document content and quality, (2) a walkdowns of the facility, and (3) interviews with facility and Laboratory personnel. The methodology for the self-assessment is presented in detail in the paper.

The team that performed the assessment included individuals from inside and outside the Laboratory with the relevant combination of experience and expertise to perform the assessment. The team was chosen to be independent of the documents it examined. It was allowed to comment critically on the document and the process used to generate it but also was allowed to provide a path forward for improving the product in the future.

In general, the results indicated that the older the SAR, the more likely it was to not meet current DOE orders and standards. The quality of SARs was improving with time, but only recently have SARs begun to meet current DOE expectations. Many generalizations can be drawn from the data, including the most common problems seen with older SARs. These data are presented and discussed.

The self-assessment also included an analysis of the causes for many of the SAR deficiencies. These causes are general and can be related to many DOE sites. These causes will be discussed in detail, as will the improvements to the SAR process that they generated.

Finally, a path forward on improving the quality of SARs at Los Alamos has been negotiated with the local DOE field office. This path forward includes a short-term plan to upgrade the older SARs examined in the self-assessment and a plan to improve the process for developing and maintaining AB documents at the Laboratory for the long-term future.

INTRODUCTION

As part of its commitment to the Department of Energy (DOE) in the University of California contract to manage the site, Los Alamos National Laboratory performed a self-assessment of the quality of its older Authorization Basis (AB) documents. Los Alamos wanted to look for vulnerabilities in the existing safety bases for its nuclear facilities. Only older safety documents were examined; other newer safety documents were believed to be adequate. Laboratory management felt it had a responsibility to take a critical look at its documents and the process used to generate and approve them. Because time would not allow for all facilities to be examined, of the 19 nuclear facilities at the site, the 10 facilities with the oldest documents were examined.

For the purposes of this review program, the AB is the set of safety documents approved by DOE that governs facility operations and that DOE uses to authorize operations. These documents include Safety Analysis Reports (SARs), Safety Assessments (SAs), Technical Safety Requirement (TSR) documents, Operational Safety Requirement (OSR) documents, and Unreviewed Safety Question Determinations (USQDs).

The review had three objectives.

1. To provide a critique of the AB for each facility by comparing it with current DOE guidance.
2. To examine each facility and its operations and determine if any “immediate safety problems” exist.
3. To understand the strengths and weaknesses of the process used to generate and maintain each facility’s AB (i.e., determine root causes).

We will first describe the process used to review the AB for each facility. The deficiencies in the AB for each facility then will be summarized and findings will be discussed. Finally, we will present the results of a root-cause analysis performed to discover any systemic issues associated with developing and maintaining ABs.

REVIEW PROCESS

To perform the AB critiques, the review team developed general review criteria based on the five steps of Integrated Safety Management: define work, identify hazards, evaluate hazards, identify controls (features that prevent and mitigate accidents), and implement controls. The team used current DOE requirements, guidance, and expectations to determine the adequacy of AB documentation (i.e., DOE-STD-3009, etc.). The review was performed for each facility by visiting the facility, interviewing facility and operations personnel, and reviewing AB documents.

The review process included the following activities.

- Review the AB documents to become familiar with the facility and the AB.
- Tour the facility.
- Discuss implementation of the AB with facility personnel.
- Interview facility personnel and other LANL support resources on the AB preparation and maintenance process.
- Evaluate the AB against the general review criteria.
- Revisit the facility to review implementation of safety-related controls.
- Develop preliminary results and conclusions.
- Prepare a draft report.
- Conduct internal review team deliberations to finalize the team’s results and conclusions.

- Verify the accuracy of information in the report with facility personnel.
- Issue the final report.

A report was prepared for the review of each facility. In addition to discussing the evaluation of each facility's AB, these reports provided specific detailed recommendations for improving the AB for each facility.

For the root-cause analysis portion of the assessment, interviews were conducted with facility personnel to determine their experience and opinions on the AB process as practiced at Los Alamos. After the reviews of the facilities were performed, interviews were conducted with DOE and other Laboratory personnel associated with the AB process.

The review team started with the general criteria that were developed for the AB Quality Review Program. These criteria are structured along the lines of the Integrated Safety Management System functions. Criteria were developed for five areas of review.

- AB Coverage of Operations
- Hazard Identification/Evaluation
- Accident Analysis
- AB Controls
- Control Implementation

To establish a common ground for judging adequacy, criteria were developed for identifying deficiencies. Two categories were defined for this review: immediate safety concern and AB deficiency. The results were categorized in this manner to facilitate developing recommendations for corrective actions.

An immediate safety concern was defined as a condition where a significant hazard is not controlled adequately. Immediate safety concerns could be identified during the review of the AB, but it was expected that any immediate safety concerns more likely would be identified during the facility tours or walkdowns. The determination of whether a hazard is controlled adequately was based on the accepted level of control that typically is applied to similar hazards at other facilities at LANL and at other DOE sites. An immediate safety concern would be identified only if the team believed that a significant worker injury or significant release of radioactive material was likely.

REVIEW TEAM

The team that performed the assessments included individuals from inside and outside the Laboratory with a relevant combination of experience and expertise to perform the assessment. The team's personnel were chosen to be independent of the documents examined. The team was allowed to comment critically on the document and the process used to generate it but also was allowed to provide a path forward for improving the product in the future.

For each facility, four to five individuals were assigned as a team to perform the review. Each team member is highly qualified with respect to education and experience and has extensive experience in developing and reviewing AB documents for DOE nuclear facilities. In addition, several team members have participated in working groups that have developed the detailed requirements for safety analysis and associated documentation for DOE nuclear facilities. The composite experience of this team gave it an excellent understanding of DOE policy and expectations for AB documents, which provides a well-founded basis for judging the quality of the AB documents.

SUMMARY OF RESULTS OF FACILITY AB CRITIQUES

The overall result of the AB critiques was that the AB documentation has significant deficiencies and does not measure up to current standards for all but one of the facilities examined. Only one facility was found to have AB documentation that generally meets current standards. The team identified three general types of deficiencies that are significant and prevalent in most ABs: (1) inadequate hazard analyses and identification of potential accidents, (2) inadequate identification and specification of controls, and (3) inappropriate use of the USQ process to maintain the AB. The first two types of deficiencies indicate a failure to develop significant parts of the core of the safety analysis as defined in DOE-STD-3009. The third type of deficiency was found to lead to the introduction of new operations while in effect bypassing the required safety analysis, formalization of controls, and DOE approvals. The review team considers these three general deficiencies to be serious, systemic problems in the Laboratory's AB documentation.

The lack of an adequate hazard analysis cascades to deficiencies in subsequent steps in the safety analysis process. The lack of a good hazard analysis causes a deficient follow-on accident analysis. In turn, important controls (safety features) are not identified in the hazard and accident analyses as they should be. In addition to deficiencies in identifying all the important controls, many of those that were identified lacked adequate definition of functional and operability requirements. In summary, the basis for the adequacy of controls was not provided. Despite this, the review team believes that the facilities are operated safely. Implementation of Laboratory safety programs addresses many of the routine types of hazards.

To put the overall results in perspective, many of the reviewed AB documents were started before Order 5480.23 and STD-3009 were issued in 1992 and 1994, respectively. In most of these cases, facility management has acknowledged the inadequacy of their existing, approved AB documentation and has attempted to update their AB documentation to the new order and standard.

One additional factor that is important to put the results in perspective is the changing expectations of the DOE office responsible for reviewing and approving Laboratory AB documents. Many of the AB documents were approved several years ago. Since then, the DOE office currently responsible for approving Laboratory ABs has judged these older AB documents to be unacceptable. Many of the deficiencies identified by the review team were implicitly accepted by DOE at one time, and there has not been sufficient time or funding to upgrade all the documents to address DOE's increasingly more rigorous standards of acceptability.

The following predominant themes can be derived from the results.

- For many facilities, all hazards have not been identified, particularly those peripheral to the primary facility processes (e.g., material storage, chemical hazards, transportation hazards, etc.).
- Hazard analyses have not been performed or lack a systematic, comprehensive approach. The analyses do not postulate a spectrum of potential accident initiators, they fail to identify the controls that either prevent or mitigate accidents, and they unjustifiably screen important accidents from further consideration.
- Many of the accident analyses are inadequate, in part because of inadequate hazard analyses. The primary deficiencies are not identifying and analyzing important accident scenarios and using technically incorrect assumptions in the accident analyses. In addition, most facilities have not evaluated unmitigated accident consequences as required by DOE standards.
- Inadequate hazard and accident analyses have led to inadequate identification of preventive and mitigative controls and a lack of definition of the safety functions of these controls.

- Nearly all facilities have not updated their AB documentation.
- Most of the facilities depend on USQDs to keep the AB current, leading to very diverse and complex sets of documents that do not comprise a coherent AB. It is extremely difficult to determine what the AB is for some operations, much less perform an evaluation of changes against it (e.g., USQD evaluations).
- Some facilities have used the USQ process to address changes beyond the scope of the USQ process, such as major facility modifications or upgrades that should be addressed by a documented safety analysis.
- For most facilities, the controls credited in the hazard/accident analyses are inconsistent with those covered by the TSRs/OSRs. The formal safety requirements have not been derived from the safety analysis.
- Many facilities are still operating to old style OSRs rather than the newer format of TSRs. OSRs lack much of the detail and formality of TSRs.
- All facilities have failed to properly define the functional or operability requirements for the safety controls covered in the TSRs/OSRs, thus raising doubts about the adequacy of the controls or their implementation.

The apparent emphasis of most of the AB documents examined is to justify the safety of existing operations. This approach does not comply with the intent of DOE safety analysis policy and the principles of Integrated Safety Management, which include systematically examining facility hazards, identifying the necessary controls, and implementing those controls. Controls at most facilities are derived from best management practices as institutionalized in Laboratory environment, safety, and health (ES&H) programs. These programs are necessary and are an important aspect of performing work safely; however, they do not alone satisfy safety policies and requirements. Current ABs do not provide a defensible basis upon which DOE or the Laboratory can be assured that facilities are being operated as safely as intended by DOE policy and Integrated Safety Management principles.

Table 1 presents a chart of generalized deficiencies and their applicability to each facility. The facilities are listed in sequence of the date of their approved base safety analysis document (i.e., SAR or SA). Although not strong, a trend of improving quality is evident. This does show some progress by the Laboratory in producing documents closer to the current DOE expectations.

To characterize the results of the facility AB critiques, it is important to note that the label “common deficiencies” is not intended to imply that all facilities used one uniform approach that was inadequate. In fact, many different approaches were found. Each facility, or in some cases each Laboratory division responsible for a few nuclear facilities, developed or established its own approach to safety analysis and preparing AB documents. This is the reason that Table 1 shows such a variety of results (some significantly deficient, some marginally deficient, and some adequate) for most common deficiencies. These facts provide strong evidence that the Laboratory (1) did not institute a uniform approach to developing AB documents and (2) did not implement a centralized internal review process with the authority to ensure Laboratory-wide consistency.

One immediate safety concern was identified by the review. At one facility, DOE-approved and issued TSRs were not formally implemented. The review team considered this to be a significant breakdown in the AB program at that facility. The situation was quickly remedied (during this review) by the facility operating organization developing and implementing new, interim TSRs that were approved by DOE.

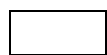


Although only one immediate safety concern was identified, the review team did identify other deficiencies that involve the safety of operations at several facilities. The team did not declare any of

these to be immediate safety concerns for two primary reasons. First, many concerns involve potential accidents of very low likelihood, eliminating immediacy as a factor. Second, many of the deficiencies

**TABLE 1
SUMMARY OF FINDINGS—AB CRITIQUE**

<i>AB Date</i>	AB Coverage of Operation			Hazard ID/Evaluation		Accident Analysis		AB Controls			Control Impl.
	<i>Not all Hazards Covered</i>	<i>Inappropriate use of USQs</i>	<i>No update</i>	<i>Poor or no HA</i>	<i>Poor Accident Selection</i>	<i>Poor Accident Analysis Methodology</i>	<i>Lack of representative scenarios</i>	<i>Controls not derived from analysis</i>	<i>Safety Systems not comprehensive</i>	<i>Lack of safety function definition</i>	<i>Uncertainty on adequacy of controls</i>
1987											
1989											
1994											
1995											
1995											
1995											
1996											
1997											
1998											

Legend

-  No deficiency
-  Marginal deficiency identified
-  Significant deficiency identified

involve potential inadequacies in backup or redundant safety measures (“defense in depth” in AB terminology). In these situations, safety programs that were of sufficient breadth and rigor to control facility hazards were found to be implemented.

EXAMINATION OF CAUSES FOR AB DEFICIENCIES

The final objective of this review was to evaluate the process for developing and maintaining AB documents. The review team received input for this part of the review by interviewing the management and staff of nine facilities included in the scope of the review. In addition, the review team obtained input by interviewing individuals from DOE organizations responsible for providing AB guidance, DOE organizations responsible for reviewing and approving Laboratory AB documents, and other Laboratory organizations involved in the AB process.

The AB process was evaluated by performing a causal analysis based on the results of the facility AB critiques, the organization interviews, and the review team’s own experience with the DOE AB program.

The objective of the causal analysis was to determine weaknesses in the AB process that led to the deficiencies in the AB documents. Failure trees were developed to examine both the AB development and maintenance processes. The failure-tree analysis considered each major aspect of the process: Laboratory preparation of AB document, Laboratory guidance, Laboratory internal review, DOE guidance, and DOE review. An example of a failure tree for producing the AB is in Fig. 1.

The causal analysis determined that significant institutional shortcomings on the part of both the Laboratory and DOE have occurred. Certain systemic patterns emerged that in general relate to (1) Laboratory management not providing centralized management of the AB program, (2) facility operating organizations not producing adequate AB documents, and (3) DOE not clearly or consistently articulating expectations or assessing Laboratory performance.

The following Laboratory management deficiencies were identified.

- The Laboratory did not provide facility-operating organizations with meaningful guidance as to what was expected for AB document preparation.
- There was a shortage of Laboratory personnel assigned to AB responsibilities who were fully aware of and conversant with DOE guidance and expectation.
- The Laboratory has not provided adequate internal reviews of AB documents that would ensure that the documents are ready for critical DOE review.
- Inadequate funding and programmatic support were provided for AB activities for several facilities.
- The Laboratory has not established an effective single point of contact with DOE to negotiate and coordinate guidelines, expectations, document reviews, and schedules.

The following facility operating organization deficiencies were identified.

- The operations culture at some facilities is resistant to adopting the formal, rigorous safety document preparation and safety requirement implementation that is the core of the Order 5480.23/Std. 3009 approach to facility operations.
- Without strong support from a central Laboratory function, some facilities did not have or have access to the detailed experience necessary for producing quality AB documents meeting DOE guidance and expectations.

The following deficiencies in DOE guidance and the DOE review process were identified.

- DOE has not provided clear expectations for meeting the general requirements of DOE policy as stated in Order 5480.23.
- Decentralization of DOE responsibility for the AB program has led to inconsistencies in DOE expectations for applying general guidance.
- Lack of clear lines of authority and responsibility between line DOE organization and safety oversight organizations and between various DOE offices resulted in inconsistent and changeable guidance and problems controlling the review process.
- DOE has not been able to provide timely reviews of AB documents.
- Delegation of AB program responsibility to the field offices has resulting in a weakened base of experience to perform AB document reviews.
- Constant reorganizations and loss of contractor support have exacerbated some of the problems identified above.

Most of the process weaknesses apply to maintaining facility ABs as well as developing them, but two issues unique to the maintenance process were identified.

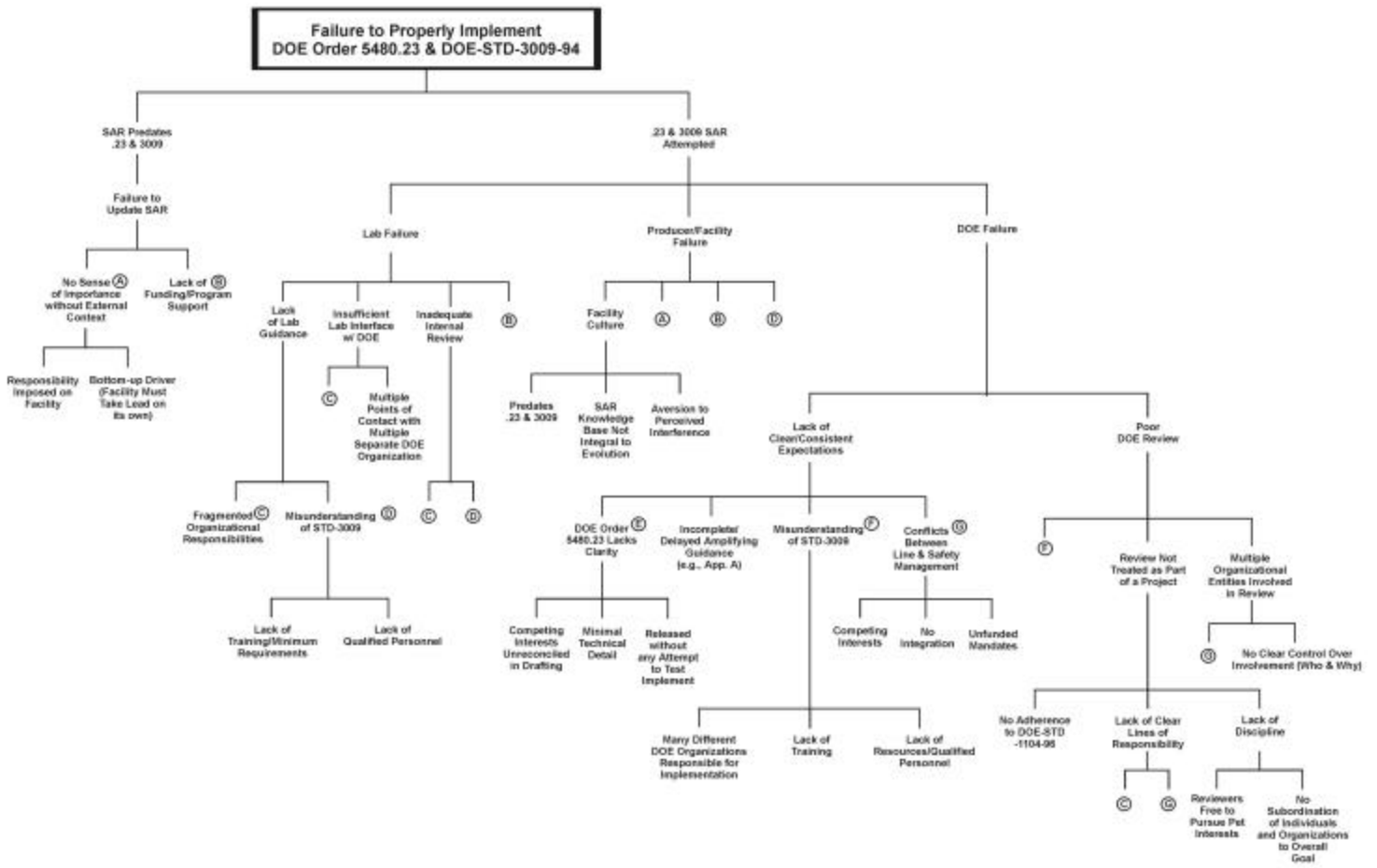


Fig. 1. Failure Tree for Developing an AB.

- AB documents are not being updated as required by DOE Order 5480.23 and as necessary to maintain a cohesive AB.
- The USQ process is being used improperly to maintain the AB by documenting the safety basis for major modifications or significant new operations in a USQD. The USQ process also is being misapplied by failing to identify changes that do constitute a USQ and that should be approved by DOE.

PATH FORWARD FOR LOS ALAMOS AUTHORIZATION BASIS DOCUMENTS

A path forward on improving the quality of AB documents at Los Alamos has been negotiated with the local DOE field office. This path forward includes a short-term plan to upgrade the older SARs examined in the self-assessment and a plan to improve the process for developing and maintaining AB documents at the Laboratory for the long-term future.

For the short term, the local DOE office has asked the Laboratory to improve the AB documentation for nine of its facilities in the fiscal year. Of these nine, six were facilities in the study. Thus, improved AB documentation for the majority of the facilities is coming shortly; the other facilities will have their AB documentation improved within the next couple of years.

To implement a longer term solution of improving the AB development process, the Laboratory has formed a committee to study and address the recommendations in this paper. The review team has developed recommendations in four areas to improve the Laboratory's AB program. The recommendations fall into four general categories.

1. Promote a centralized AB program function for nuclear facilities. This function would provide institutional guidance, oversight, and support to AB document development and maintenance to ensure that the Laboratory produces quality AB documents consistent with DOE policies and expectations. Primary responsibilities would include developing Laboratory guidance, reviewing AB documents, training analysts and managers, and acting as a single point of contact with DOE to coordinate AB activities and direction.
2. Secure the needed funding to prepare and maintain AB documents. In coordination with DOE, the Laboratory organizations responsible for funding should recognize and respond to AB program needs for developing and maintaining AB documents.
3. Control the USQ process. The USQ process should be managed more effectively through a central Laboratory AB function to ensure that (1) USQDs adequately evaluate the effect of changes on the AB, (2) the USQ process is not used for major modifications and construction projects that require more comprehensive safety documentation, and (3) the USQ process is not used to maintain the AB over long periods of time instead of updating the safety analysis document.
4. Emphasize AB program management responsibilities of nuclear facility managers. The AB program should be managed effectively by responsible facility and operations managers to comply with the Laboratory's AB program requirements. These responsibilities include AB document development and maintenance and conducting operations consistent with AB document commitments.

These recommendations will be examined in depth, and a final set of actions will be forwarded to Laboratory upper management.

The overall conclusion of this review is that the Laboratory has not managed its AB program adequately. Although there is evidence that institutional deficiencies on the part of DOE contributed to the

Laboratory's AB program deficiencies, proactive Laboratory management acting at appropriate levels could have overcome these obstacles. This conclusion is supported by the fact that the Laboratory has recently produced AB documents acceptable to DOE, as have organizations at other DOE sites. The common thread of these successful AB programs is proactive management. The review team believes that the Laboratory must assume responsibility for past AB program deficiencies. The Laboratory must take responsibility for developing and implementing its own program for producing quality safety documentation.