

**Using of Contractual Requirements to Promote Positive Evolutionary Change in Safety**  
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**ABSTRACT**

Over the last 5 to 6 years, the Department of Energy (DOE) has had mixed success in its attempt to implement its nuclear safety Orders and Standards. Based on a recent examination of the process used to maintain and develop safety bases at Los Alamos National Laboratory (LANL) and the local DOE Area Office's own experience, we believe that keys to successfully implementing the DOE Orders and Standards must include the following:

- A commitment on the part of DOE to clearly articulate its expectations in this area;
- A commitment on the part of the Laboratory to put forth the necessary resources to meet these expectations; and
- A mechanism to measure the progress toward full implementation of all relevant DOE Orders and Standards, which would include high-quality safety-basis products.

To meet these goals, DOE-LAAO with the aggressive support of LANL has been using the contractual obligations with the Department to promote positive evolutionary change in safety. These contractual requirements provide motivation to improve safety to both the Laboratory and the Department, as well as provide a means of providing feedback to the Laboratory on its progress. A penalty to the score is, of course, necessary when the negotiated expectations are not met; however, the point system should also reinforce positive results. Therefore, efforts to correct deficiencies, improve knowledge, train, or improve process are used to gain back points for the Laboratory.

LAAO believes that the use of contractual requirements is fully in line with the Integrated Safety Management (ISM) approach, which fosters the perspective that safety be built into the process, instead of being reviewed in. It is also a variation on the Deming Plan-Do-Check-Act (PDCA) Cycle, which states that to promote quality one must:

- Plan (Set goals based on customer needs): Define work scope and mission needs, identify hazards, prioritize activities
- Do (Implement): Allocate resources and categorize and analyze hazards, develop controls, implement controls, confirm readiness, perform the work
- Check (Analyze what happened): Collect feedback, identify improvement opportunities
- Act (Ensure change is permanent): Ensure performance and make changes to improve

This paper will discuss the process that LAAO and LANL has put together to achieve high-quality safety documents at LANL. The main focus will be on the use of contract measures to place management emphasis on where organizations (in this case, LANL/ DOE) desire to evolve processes like authorization basis.

## **DEFINITION OF THE PROBLEM**

Over the last 5 to 6 years, the Department of Energy has had mixed successes in its attempt to implement its nuclear safety orders and standards. Examples in the DOE complex abound.

For example, symptomatic indicators of process problems include one DOE site that has had only one 5480.23/5480.22 compliant authorization basis approved in about eight years. Another DOE site has not produced a credible authorization basis (AB) in many years and is currently relying on BIOs and JCOs for its operations. At LANL, observations starting in about 1996 indicated that there were problems with the USQ and AB processes. These preliminary indicators started to build over a period of time until Laboratory and Area Office personnel came to a consensus that there could be systemic underlying process problems.

Specific indicators of process problems at LANL included category 2 nuclear facilities with natural gas piped through them without analysis of deflagration scenarios, incorrectly identified evaluation-basis earthquake accelerations, use of mitigated or controlled analyses for consequences rather than unmitigated consequences, incorrectly derived airborne release fractions and accident consequences, and missing accidents. As a consequence, there were incorrectly derived type, number, and pedigree of safety controls. The Department had approved these ABs.

## **INTEGRATED SAFETY MANAGEMENT AND RELATIONSHIP TO DEMING/SHEWHART CYCLE**

ISM uses a five-step process to ensure that safety expectations are established, implemented, measured, and reinforced in work activities. The five core functions of ISM are as follows:

1. Define the scope of work
  - Translate the mission into work and set expectations/goals
2. Analyze the hazards
  - Identify hazards
  - Analyze hazards
3. Develop and implement controls for safety
  - Identify controls to prevent/mitigate hazards
  - Implement controls
4. Perform the work
  - Confirm readiness
  - Perform work with safety controls
5. Ensure performance
  - Collect feedback
  - Make changes to improve/assure performance

The five-step ISM process is presented graphically below in Figure 1.

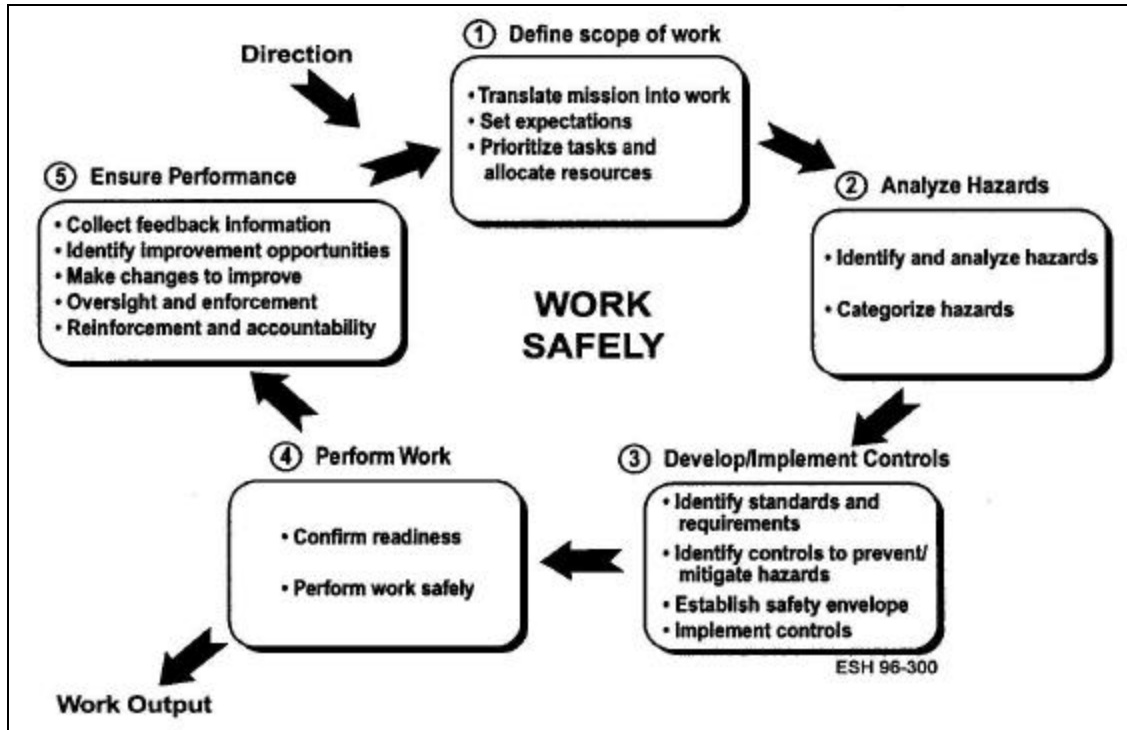


Figure 1. Five-Step ISM Process

Careful review of the ISM precepts presented above against the Deming cycle indicates that ISM is basically an implementation of the Deming cycle, which is outlined below in Figure 2.

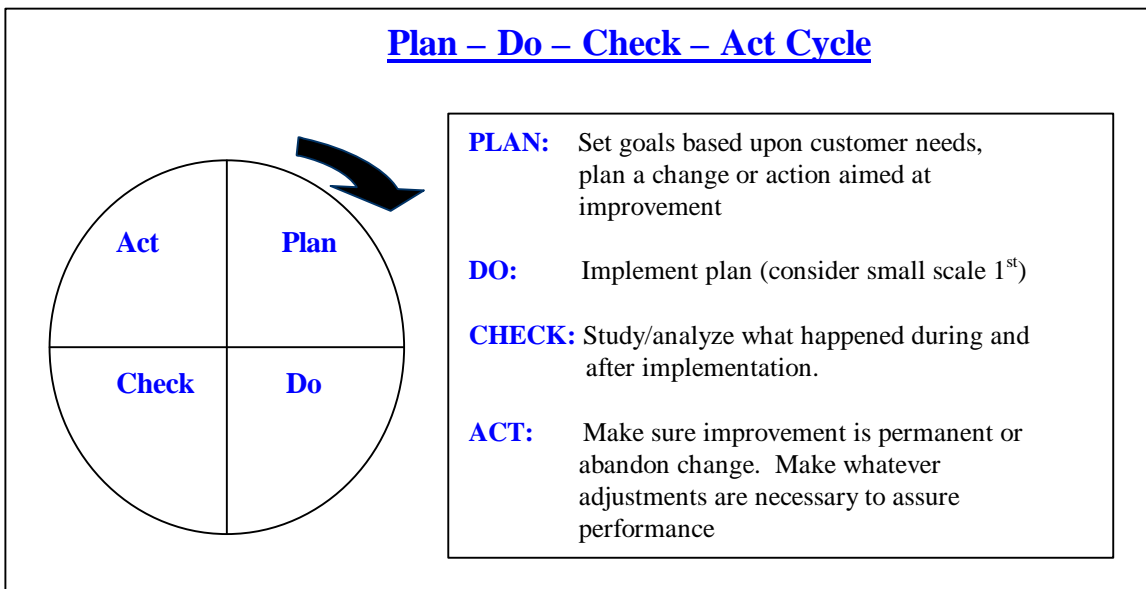


Figure 2. Deming/Shewhart Cycle

The Plan part of the Deming cycle corresponds to ISM step 1; the Do part of the Deming cycle corresponds to ISM steps 2, 3, and 4; and the Check/Act part of the Deming cycle are mapped to ISM step 5. In this manner, one may understand that ISM is basically a particular application of the Deming quality cycle for the continuous quality improvement of safety.

## **APPLICATION OF BASIC QUALITY/ISM PRECEPTS TO THE SAFETY ANALYSIS PROBLEM**

Starting in 1996, LAAO and the Laboratory started to use primitive performance measures in the contract to monitor progress in the USQ arena as well as in quality of safety analyses. The initial indicators were simple numerical measures (how many USQDs were poorly done, how many TSR violations had occurred, etc.) aimed at supplying feedback to management on the results of management attention to the quality issues. As understanding of the quality issues improved, less primitive quality improvement measures were sought such as memoranda of understanding that clearly articulated quality expectations for the AB process. In 1998, approval authority for authorization bases transitioned to LAAO.

As the state of knowledge of the process continued to grow and the measures showed no discernable improvement, LAAO and LANL opted to use step one of the Deming and ISM processes to perform a full-scale investigation of the quality of 10 LANL authorization bases that were produced prior to 1998 (one AB was produced in 1998). The Authorization Bases failed to meet defensibility requirements with one exception that was produced in 1998. Root-cause determinations were required as part of the contract performance measure for both the Department and LANL processes. A formal review plan was made part of the LANL contract, which included the following specifics:

1. Establish the scope of the study (which facilities were to be sampled) and timelines for the study.
2. Develop a detailed review plan (included in the contract).
3. Perform the quality review of the AB documents.
4. Identify any imminent safety issues and immediately notify the Department for action.
5. Identify any interim compensatory measures that are required to ensure safety.
6. Perform a LANL and DOE process root-cause analysis of any deficiencies to include interviews with facility, local DOE, DOE Operations Office, and DOE-HQ personnel. Specific guidance was supplied for root cause expectations.
7. Identify and submit corrective actions for root-cause process deficiencies discovered.
8. Track the costs of the study as part of the performance measure.

The final report, Los Alamos National Laboratory report LA-CP-99-259, titled “Authorization Basis Quality Review Final Report Summary of Findings and Examinations of Causes for LANL Authorization Basis Deficiencies,” was completed on September 28, 1999, and forwarded formally to the Department Senior Authorization Basis Manager for Los Alamos. Under the contract, the Laboratory earned a grade of excellent for the report.

Some of the causes that have been formally identified for the AB quality issue in the report include lack of detailed technical oversight and trained personnel by the Department and LANL; lack of a proactive and fully engaged management stance in the Department and LANL on AB issues; less than adequate delineation of clear, detailed, and enforced expectations in the LANL and DOE processes; less than adequate technical training of Departmental and LANL safety analysts; and lack of a technical engineering developmental track for Departmental personnel, lack of a quality review process in LANL and the Department, lack of adequate Department and LANL resources, lack of a coherent and technically based single point of contact with the Department, lack of cooperative attitudes at LANL, lack of clear lines of Departmental authority and accountability, as well as the perception among many that the Program is somehow separate from Safety rather than both of these objectives being symbiotic and integral parts of the larger overall Mission (in a Venn diagram; Mission = Safety  $\cup$  Program) objective.

As the final report was being produced, LAAO and the Albuquerque Operations Office were already implementing corrective actions based on a more informal causal analysis that had been performed by the Department and presented to Laboratory and Operations Office Management on August 31, 1998. Although this causal analysis was less robust than the LANL contract effort, the crude Departmental causal analysis was of sufficient pedigree to allow the Operations Office to move out on corrective actions with some assurance that the effort would not be wasted. Further details are available in the Attachment 1 to this paper and will not be pursued here further.

## **SECOND PHASE OF CORRECTIVE ACTIONS FOR THE LANL PROCESS**

The subject of the 1999 (FY 2000) LANL contract performance measures is two-fold, tactical and strategic. Both approaches are necessary because the Department cannot afford a series process whereby root cause Authorization Basis corrective action plans are developed over protracted time periods with the follow on action of producing the new Authorization Bases.

In a tactical approach, it was agreed that LANL and the Department would produce nine authorization bases using a 30%/70% /90% review process designed to catch mistakes before they snowball. In a parallel, strategic approach, LANL would present a plan to correct the root causes identified in the LANL report no later than May 15, 2000.

As of March/April, 2000, three of the nine AB revisions have been completed and approved and the Laboratory has completed the development of a draft corrective action plan to address the Laboratory AB process causes. In April, another Authorization Bases is on track for approval. The Laboratory is currently on schedule to meet all of the contractual commitments for submittal of the plan to the Department.

## **CONCLUSION: IMPROVING THE PROCESS IN THE FUTURE FOR THE REST OF THE COMPLEX**

LAAO believes that the Laboratory has been very receptive to correcting the AB deficiencies. It should be noted that the AB deficiencies outlined in this paper are not specific to the Laboratory but are in fact endemic at many, if not all, Department sites. That this is in fact the case is borne out in part by Defense Nuclear Facility Safety Board (DNFSB) recommendations relative to technical competence such as DNFSB/TECH-10, as well as DNFSB 93-3 and previous site-specific DNFSB recommendations and numerous trip reports.

On September 21, 1999, LAAO received a commendation from the DNFSB Technical Director for the efforts that the office had made with regard to the technical training of Departmental safety analysts (Attachment 2).

On March 2, 2000, the Chairman of the DNFSB wrote a letter (Attachment 3) to the Deputy Secretary of Energy commending the Laboratory and the Department for the quality of the AB self-assessment report in the context of a major ISM initiative. A recommendation was made for similar assessments to be performed across the complex as part of the feedback and improvement process of ISM. The letter further specifies that the kind of assessment performed by the Laboratory and the continuous upgrading of safety-basis documentation should be recognized by DOE as representative of the effort that will be warranted in the post-September period at sites other than LANL and that such programs might well be considered a Phase III effort in the implementation of ISM throughout the complex. In this context, the Board has requested a briefing on what other sites will be performing AB self-assessments as part of ISM and on DOE's resources, roles, and responsibilities for reviewing AB documentation.

Note: The views in this paper do not necessarily reflect the viewpoints of the Department on contract issues.

## APPENDIX

### STRATEGIC SAFETY ANALYSIS OBJECTIVES AT LANL

DOE LAAO performed a causal analysis and then presented the information in an oral presentation on what was found to the Los Alamos National Laboratory Director (Dr. Browne), and AL management that attended on August 31, 1998. The causes that were identified and presented are as follows:

#### CAUSES

##### DOE Review & Approval Process is Less Than Adequate (LTA) Because:

DOE 1. DOE Resource Levels & Training is LTA

DOE 2. Confusing & Inconsistent Guidance is Given by the Department, no Single Accountable Point of Contact

DOE 3. Defined Expectations are LTA (and Inconsistent)

DOE 4. Accountability Not Clearly Defined & Enforced

##### LANL Review & Internal Approval Process is LTA Because:

LANL 1 Institutional Consistency/Ownership/Enforced Accountability @ Division Level for Safety Analysis Modeling Assumptions & Process Review LTA

LANL 2. Training of Safety Analysts (and USQ personnel) is LTA

LANL 3. Utilization of In-House Expertise is LTA

To correct these deficiencies the following strategic actions were identified and implemented at LANL.

#### LAAO INITIATIVES TO ADDRESS CAUSES IDENTIFIED ABOVE

- LAAO and LANL have identified key personnel to address authorization basis issues (addresses causes DOE 2, DOE 3, DOE 4)
  1. LAAO Senior Authorization Basis Manager (SABM) was appointed in 1998.
  2. SABM SAR, TSR, USQ approval authorities and responsibilities clearly defined in memo from Area Manager dated May 13, 1999
  3. AL Function, Roles, and Responsibilities (FRA) issued on February 11, 1998. Delegated AB approval authority for all existing facilities to LAAO.
  4. Delegation by Twining to LAAO of USQ and JCO Approval Authorities (memo dated June 23, 1997).

- LANL SAR ‘Czar’ Appointed by LANL in Dec 1999 by LANL Operations Director (addresses cause LANL 1 by bringing accountability into process by injecting the program funding authority into safety analysis issues)
- ESH-3: LAAO and LANL established ESH-3 as LANL Office of Institutional Coordination by signing MOU on Feb 13, 1998 (“MOU-UC Contract Appendix F- Quality of Safety Basis Documentation for Nuclear Facilities”)—(addresses cause LANL 1)

■ LAAO and LANL have clarified Authorization Basis and USQ expectations:

- Appendix F Performance Measures- requires authorization basis quality reviews—This 1999 performance measure that LAAO negotiated with the Laboratory requires an assessment by qualified experts at LANL of the current quality of the AB documents for nuclear facilities followed by immediate action if any imminent safety issues are discovered and also required a formal causal analysis for problems discovered). It is aimed at obtaining formal recognition of quality issues from LANL (formal recognition is the first step in fixing the problem in a strategic manner). TSA-11 required to do this. (this addresses causes LANL 1 and LANL 3). FY 2000 measures aimed at fixing the AB problems.
- MOU signed Feb 13, 1993 - Quality of Safety Basis Documentation for Nuclear Facilities. Defines institutional accountabilities and authorities of ESH-3. Also addresses USQ and AB process quality issues. ESH-3 has training responsibility under MOU for USQ process (addresses causes LANL 1 and LANL 3)
- LANL LIRS - Developing LANL requirements for implementing 5480.21, .22, & .23. Addressing this issue under ISM is part of the LANL contract performance evaluation for off ramp (this helps to address causes DOE 3, LANL 1)

■ LAAO and LANL are ensuring that authorization basis efforts are appropriately prioritized:

- Prioritization of safety analysis work has been accomplished with joint LANL/LAAO (LANL SAR CZAR/SABM/ESH-3) prioritization list. The 1<sup>st</sup> list was completed in late 1998. An updated list is due in July/Aug timeframe. (addresses causes DOE 1, LANL 1)
  - LAAO Updated nuclear facility list in December 1998. This was an extremely important issue because LANL and DOE had multiple lists since 1991 that were not consistent. This interfered with resource allocation issues and resulted in extra DOE costs for safety analyses (addresses causes DOE 1, LANL 1).
- LAAO interaction with senior LANL managers through OWG and Issues Management Board on weekly basis (addresses causes DOE 2, DOE 3, LANL 1)

- LAAO has taken the initiative to acquire additional resources (SABM now has a staff of 3). (addresses DOE 1)
- SABM successfully requested support multiple times from DP-45 (Chung/Kimball) and 1-2 staff and 40K for ARF, RF DOE/NRC acknowledged expert for use at LAAO for safety analysis work and teaching/mentoring of safety analysts. (funding unclear for Jofu use in 2000) helps to address DOE 1). Open issue in HQ is continued HQ support for DP-45 (HQ funding cuts for DP-45 in 1999 from about \$17M to \$2M).
- Support from EH: Senior EH analyst detailed to LAAO (support was in place for 3 months in 1999, EH has since withdrawn support commitment). (helped to address DOE 1)
- Training.
  - LAAO mentoring activities for AL safety analysts has started. SABM requested assignment of 1 SASD safety analyst to LAAO in mentoring role. Started activity In June, 1999. Analyst is at LAAO every Tues, Wed, Thurs). (helps to address DOE 1)
  - ESH-3/NMT-DO Sponsorship of New RF course at request of SABM (helps to address DOE 1 and LANL 2)
  - SABM sponsored second course in Sept 1999. (helps to address DOE 1 and LANL 2)
  - SABM/and AAMFO are paying for a hazards analysis course for LAAO safety Analysts and Facility Representatives as well as AL safety analysts taught in Aug 1999. (helps to address DOE 1)
  - ESH-3 has sponsored >5 USQ training courses since MOU was signed (helps to address LANL 1 and LANL 2)
  - SABM constructed for AL a training course matrix for confirmatory analysis. Moving ahead slowly. (helps to address DOE 1).
  - SABM requested training plan be developed for AL safety analysts in June 1998. Plan is now in final stages of development. (helps to address DOE 1).
  - LAAO has obtained work stations for all safety analysts to do engineering analysis on. Codes available for safety analysis are MACCS2, CONTAIN, KENO, MELCORE, MCNP, MATHCAD, BLASTX, SLAB, DEGADIS, ALOHA, FAST 3.1.2, CFAST, ERAD, SHOCK, FRANG, RASCAL, CHEETAH, SCREEN, etc.

- Aggressive and substantial responses have occurred relative to the technical competence issue as it applies to AL. A contributing cause to this is no technical track for DOE safety analysts (this has started to change recently with the use of excepted service positions in DP-45, EH, AL, Oakland, and elsewhere). In particular the following courses/actions have occurred/been sponsored specifically for safety analysts starting in late 1998 to 1999 to help with the technical qualification issue for safety analysts:

- ▶ 32 HR SEISMIC ANALYSIS COURSE (SEPT., 1999 SPONSORED BY AL)
- ▶ QUALIFYING OFFICIAL TRAINING (SPONSORED BY AL)
- ▶ 24 HR DOE-STD-3009 COURSE (SPONSORED BY AL SEPT., 1999)
- ▶ 32 HR ACCIDENT SCENARIO DEVELOPMENT AND QUANTIFICATION COURSE (SPONSORED BY AL MAY, 1999)
- ▶ 40 HR SAFETY SYSTEMS TECHNIQUES COURSE (HAZARD ANALYSIS SPONSORED BY LAAO) (AUG., 1999)
- ▶ 4 DAY FUNDAMENTALS OF QUANTITATIVE RISK ANALYSIS COURSE (SPONSORED BY AL)
- ▶ 1 DAY SEISMIC COURSE (MARCH 1999 SPONSORED BY LAAO)
- ▶ 3 DAY COURSE ON USE OF RELEASE FRACTIONS IN SAFETY ANALYSIS (SPONSORED BY ESH-3 AND AGAIN BY LAAO FIRST TIME TAUGHT IN DOE COMPLEX, ATTENDED BY 4 DNFSB STAFF MEMBERS, TAUGHT BY DOE LAAO AND THE AUTHOR OF 3010) (STD-3010)
- ▶ 4 DAY COURSE ON MCNP SHIELDING MODELING AND CRITICALITY ANALYSIS (SPONSORED BY AL)
- ▶ 4 DAY COURSE ON PLUME MODELING USING MACCS2 (SPONSORED BY AL)
- ▶ 4 DAY DOE TSR COURSE (SPONSORED BY ESH-3)
- ▶ 4 DAY DOE USQ COURSE (SPONSORED BY ESH-3 MULTIPLE TIMES)
- ▶ LAAO IS MENTORING SASD SAFETY ANALYSTS (1 AT A TIME FOR 3 MONTHS)
- ▶ USQ COURSE (MULTIPLE COURSES SPONSORED BY AL)

In addition:

- ▶ QTD WORKED WITH LAAO AND AL SAFETY ANALYSTS TO FINALIZE A QUALIFICATION CARD FOR SAFETY ANALYSTS IN 1999.
- ESH-3 USQ Sampling Report Completed Aug. 28, 1998 (helps to address LANL 1 and LANL 3).