

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

June 24, 1993

MEMORANDUM FOR: G. W. Cunningham

COPIES: Board Members

FROM: J. T. Arcano, Jr.

THROUGH: M. B. Moury
S. L. Krahn

SUBJECT: Pantex Trip Report for May 18-20, 1993, Review of
Quality Assurance

1. **Purpose:** This memorandum describes the observations of Defense Nuclear Facilities Safety Board (DNFSB) technical staff (J. T. Arcano, Jr. and W. C. Moore) and Outside Experts (J. D. Porter, J. D. Stevenson, and R. L. Thompson) during a review of the Department of Energy (DOE) Amarillo Area Office (AAO) and Mason & Hanger-Silas Mason Company, Inc. (M&H) Quality Assurance Program from May 18-20, 1993. A follow-up review of the facility design process used at Pantex was conducted on June 17, 1993.

The review consisted of briefings by AAO and M&H, a review of quality assurance policy directives, personnel interviews, and observation of weapons disassembly operations. The DNFSB Quality Assurance Review Guide was used as a basis for this review in which AAO and M&H were evaluated against the ten criteria of DOE Order 5700.6C.

2. **Summary:** Implementation of DOE Order 5700.6C by AAO is in the development stage and severely lacking in formal implementation. Implementation by M&H is much better structured but overall still in its infancy. Both AAO and M&H quality assurance programs will require significant development in establishing implementation documentation and verifying compliance across all areas which could affect public health and safety. However, proactive upper level management at both AAO and M&H is attempting to instill a quality culture at Pantex which more fully embodies the tenets of DOE Order 5700.6C. Specific areas of concern to the review team include:

- a. **AAO:**

- (1) The AAO "Operations Quality Assurance Procedures Manual" places no requirements for DOE Order 5700.6C Criteria 2 (Personnel Training and Qualification), 3 (Quality Improvement), 5 (Work Processes), 6 (Design),

7 (Procurement) and 8 (Inspection and Test Requirements) on any of the seven AAO branches.

- (2) AAO lacks an independent assessment program as required by Criterion 10 of DOE Order 5700.6C.
- (3) AAO does not have an implementation plan for DOE Order 5700.6C and therefore lacks a benchmark against which their progress towards coming into compliance can be measured and tracked.

b. M&H:

- (1) M&H training efforts have not been expanded significantly beyond production to other areas which could affect public health and safety, such as procurement quality assurance and receipt inspection.
- (2) M&H lacks an adequate facility design verification process.

3. Discussion:

a. AAO:

- (1) The AAO "Operations Quality Assurance Procedures Manual" does not require the application of DOE Order 5700.6C Criteria 2 (Personnel Training and Qualification), 3 (Quality Improvement), 5 (Work Processes), 6 (Design), 7 (Procurement) and 8 (Inspection and Test Requirements) for any of the seven AAO branches. (The Operations Quality Management Branch Chief stated that all the requirements of DOE Order 5700.6C apply to all the AAO branches, however, the Manual does not reflect this.) Also, the Manual provides little, if any guidance concerning quality improvement (Criterion 3), work processes (Criterion 5), design (Criterion 6), procurement (Criterion 7), and management or independent assessments (Criteria 9 and 10). As the basis for the quality assurance program at AAO, the Manual provides inadequate guidance to personnel and to lower-tiered implementing documentation on the requirements of DOE Order 5700.6C.
- (2) AAO does not have an internal independent assessment organization which focuses on improving quality and process effectiveness, as required by DOE Order 5700.6C. The AAO Area Manager stated that independent assessments are not conducted internal to AAO since he does not have the manpower to conduct them; he relies on external independent assessments.

However, without formal independent assessment AAO lacks the ability to independently identify deficient conditions and provide input for modifications to the Area Office training program.

- (3) AAO does not have an implementation plan for DOE Order 5700.6C and therefore lacks a benchmark against which their progress towards compliance can be measured and tracked. For example, several of the AAO Branch Quality Assurance Plans have not been revised from 5700.6B to reflect the requirements of DOE Order 5700.6C. The lack of an implementation plan leaves AAO's intentions and progress unclear with regard to revision of these documents.

However, AAO has recently started an effort to determine their degree of compliance with this Order and are planning and implementing programs to improve the degree to which and the rate at which they are coming into compliance. The Technical Self-Assessment Program and the Area Manager's Self-Assessment Program are examples of such programs.

b. M&H:

- (1) The DNFSB staff review indicates that M&H meets DOE Order 5700.6C Criterion 2 (Personnel Training and Qualification) requirements in the area of production. However, for full compliance, training efforts need to be expanded beyond production to other areas which could affect public health and safety. For example, no formal training was evident for procedure writing skills outside the manufacturing division, for design engineers in developing functional design criteria and in reviewing architect/engineer (A/E) design documents, or for procurement quality assurance and receipt inspection. The three areas sampled identified only informal on-the-job training being used.
- (2) Review of the Pantex Special Nuclear Material Staging Facility (Building 12-116) design indicates that M&H lacks an adequate facility design verification process, such as that presented in ASME/ANSI NQA-1 "Quality Assurance Program Requirements for Nuclear Facilities" (Supplement 3S-1, "Design Control"). In addition, neither M&H nor their architect/engineer have any procedure where structures, systems and components (SSCs) which are vital or essential to safety receive any level of design evaluation or review more rigorous than that performed for conventional SSCs.

c. Additional comments concerning this evaluation are presented as Attachment 1.

4. Plans for Future Staff Review: The following future staff actions are planned:

- a. Conduct a more in-depth review of management and independent assessments at Pantex. Particular emphasis will be placed on how the results of these assessments are used.
- b. Conduct a more in-depth review of the document control system with particular emphasis on control of vendor manuals. (Preliminary review indicated this area was evolving and will require more detailed review in the future.)

Observations During an Evaluation of Quality Assurance at Pantex

I. Quality Assurance History at Pantex:

1. DOE Order 5700.6C, "Quality Assurance," establishes requirements for quality assurance throughout the DOE. Work associated with nuclear weapons administered by the Assistant Secretary for Defense Programs is excluded from this Order. However, work associated with the design, construction, fabrication, operations, maintenance, decommissioning, and decontamination of facilities and equipment used to produce weapons are not excluded. The Order calls for appropriate attention to be given to the weapons component and production interfaces. In lieu of DOE Order 5700.6C, DOE/AL "Quality Criteria" (QC-1) prescribes the basic quality principles and requirements for procurement and/or production of weapons and weapons related material and software.
2. "Quality Criteria"(QC-1) has provided the basis for a product-oriented weapons quality assurance program at Pantex since the mid-1950's. In 1987, the M&H weapons quality assurance program was shifted to be more process-oriented by eliminating the product acceptance inspection division. Responsibility for quality control was transferred to the line organization. In 1988, DOE Order 5700.6B invoked "Quality Assurance Program Requirements for Nuclear Facilities" (ANSI/ASME NQA-1) as the basis for non-weapons quality assurance. In 1990, the weapons and non-weapons quality assurance organizations were combined into the current Quality Division.
3. M&H has adopted a functional approach to quality assurance that blends the most stringent requirements of QC-1 and DOE Order 5700.6C. Therefore, guidance documents used by operators are transparent to whether the source is QC-1 or 5700.6C. This effectively eliminates interface problems between the applicability of the two documents. The M&H Quality Division supports this approach in that it incorporates both weapons (QC-1) and non-weapons (DOE Order 5700.6C) quality assurance.
4. The M&H quality assurance program includes an immature plant process audit program, a procurement audit program, a surveillance program, an improving document control system, and a mature metrology program. Issues management, trend analyses, root cause analyses, and lessons learned are also aspects of the program.

The Quality Division Manager is responsible for the effectiveness of the quality program, the corrective action program, the metrology program, and the weapons product acceptance program. He is not independent of the line organization since the program management branch reports to him. However, independent assessments are conducted under the Information Management Division Manager who is independent of the line organization and who also reports directly to the General Manager. This is consistent with DOE Order 5700.6C Criterion 10 (Independent Assessment) requirements.

5. The AAO approach to quality assurance differs from that of M&H: AAO maintains a Weapons Quality Management Branch which is different and distinct from the (non-weapons) Quality Management Branch. In fact, the AAO Operations Quality Assurance Procedures Manual, which reflects DOE Order 5700.6C, exempts activities controlled by QC-1 from its requirements. This is inconsistent with the M&H practice of applying the most stringent requirements of either QC-1 or DOE Order 5700.6C across the board.

II. Evaluation of Pantex Quality Assurance Programs against DOE 5700.6C Criteria: AAO and M&H quality assurance programs were evaluated against all ten quality criteria of DOE Order 5700.6C to various degrees of detail. Listed below, by criteria, are key observations made by DNFSB Staff and Outside Experts during the review. Lack of an observation concerning either AAO or M&H for a particular criterion means that no substantial comments were warranted.

1. Criterion 1: M&H Written Quality Assurance Program:

- a. The Pantex facility is unique in that it does not have a quality assurance manual, per se, but a "Quality Assurance Program Description" which is a compilation of 14 previously fragmented policy directives and implementation procedures. Appendix A of this document provides a "Summary of the Program" which follows the format and description of the 10 criteria of DOE Order 5700.6C, adding two new criteria: "Measuring and Test Equipment," and "Software Quality Assurance Program." The bulk of this document consists of 13 Pantex Policy Directives and one Pantex Plant Standard intended to implement DOE Order 5700.6C and DOE/AL QC-1. The thirteen policy directives and plant standard are very general in nature; they provide little guidance or reference to lower tier plant documents that should be used to implement these policy directives. (Lower-tiered documents were not reviewed; Their effectiveness in presenting Quality Program guidance was not evaluated.)

The plant standard "Program Management" makes the Quality Division Manager responsible for the effective management of weapon programs and

designated projects instead of the immediate supervisor. This dilutes the principle that quality is a line responsibility.

- b. A "stop work" philosophy is evident. Workers who were interviewed conveyed their feeling that unsatisfactory or unsafe work can be stopped. This was exemplified in January of this year when the General Manager directed that anyone could stop work if they had a procedure that was in error or not clear, or that couldn't be performed as written. This resulted in a two week work stoppage, during which procedures were corrected and made more clear and usable for production technicians.

2. **Criterion 2: Personnel Training and Qualification**

- a. **AAO:** AAO personnel are being trained in DOE Order 5700.6C concepts to perform performance-based evaluations. This effort consists of lead auditor training, surveillance training, and facility representative training. To date, approximately 30-50% of field office personnel have been trained.
- b. **M&H:**
 - (1) M&H is conducting comprehensive job and task analyses to better define training and qualification requirements for workers, supervisors, and managers. Job analysis is scheduled to complete in June, 1993; Task analysis is scheduled to complete around June, 1995.
 - (2) During this review, the Training Manager, accompanied by the General Manager, toured training facilities to interview trainees, providing management assessment feedback to the training program.

3. **Criterion 3: Quality Improvement**

- a. **AAO:**
 - (1) Fifty-five percent of the performance criteria evaluated by AAO in determining M&H's award fee is attributed to environmental, safety and health issues.
 - (2) An Issues Management Board has just been established. The purpose of this Board is to assess and manage the resolution of contractor operational issues. Input to the Board will be provided

from a variety of sources such as Field Representatives' observations, performance indicators, quality assurance surveys, and appraisal findings. The Board will then prioritize these issues, present them to the contractor, and ensure validation of corrective actions.

b. M&H:

- (1) A sampling of various personnel across the contractor organization indicated that the message that quality is everyone's business is well embraced at the levels sampled.
- (2) A "no-fault" attitude is evident in which workers are free to identify issues related to quality and safety.
- (3) The General Manager makes significant use of statistical monitoring of performance indicators to focus senior management's efforts. In fact, management performance is evaluated based on meeting performance indicator goals.
- (4) A Corrective Action Program is in place that provides for the identification, documentation, analysis, resolution, and validation of corrective actions to deficient items and processes. However, an orderly tracking system to monitor the status of corrective actions was not evident.
- (5) A core group of five personnel has been established for root cause analysis, which is used for occurrence reports on a case basis. An interview with a group member (a procurement auditor), revealed that the employee was experienced, and formally trained in root cause analysis. The employee reported that excellent technical support was provided for root cause analysis, as required.
- (6) M&H has established an aggressive benchmarking program which taps off knowledge gained by commercial endeavors in areas such as conduct of operations, training, metrology, and performance indicators.
- (7) Interviews of a manufacturing technician, a manufacturing supervisor, and a building manager revealed a very positive attitude about the enhanced attention and emphasis given to quality, improved training and procedure enhancements.

4. **Criterion 4: M&H Documents and Records:** A computerized Document Control Master Index identifies the latest versions of controlled documents. However, no recall program exists for superseded documents; it is the user's responsibility to ensure that they are using the latest document version. Also, preliminary review has indicated a potential problem with regard to inadequate control of vendor manuals throughout the site.

5. **Criterion 5: M&H Work Processes:** Operation and Instruction (O&I) Procedures for weapons dismantlement are being upgraded into more user-friendly Nuclear Explosive Operation Procedures (NEOPs). NEOPs will be developed and used on specified nuclear weapons programs.

6. Criterion 6: M&H Design: The following information is based on a review of the Special Nuclear Material Staging Facility (Building 12-116) design:

- a. The M&H Plant Design Department does not do any significant design itself but does develop functional design criteria for outside Architect/Engineers (A/E) which are contracted to provide engineering and design for specific projects. Based on the functional design criteria prepared by the Plant Design Department, the A/E prepares Design Basis Documents. These documents are generated for various disciplines including civil, structural, mechanical, electrical, architectural, etc., and are reviewed by the Plant Design Department.

The Plant Design Department also reviews detail design documents which include plans (drawings), specifications and Design Reports (calculations) generated by the A/E, and provides comments to the A/E. There is no formal approval of the A/E detailed design documents since legal responsibility for the design resides with the A/E.

Neither M&H nor their A/E have any formalized training, qualification, or licensing program which defines the responsibilities of the (for the A/E) (1) originator, (2) checkers, and (3) approver of design documents, or (for M&H), the approver of the design basis documents. This results in major inconsistencies in both the content of and the depth of reviews by different personnel.

- b. Procedures have been established to control the design requirements, inputs, outputs, changes, records, and organizational interfaces. All design changes must be justified and are subject to the same controls as the original design.

All designs are also subject to independent review and verification. However, M&H considers routine checking and approval of design documents to be "independent review and verification." This would be acceptable if this activity is considered a "Design Review" in accordance with ASME/ANSI NQA-1 (Supplement 3S-1) and includes the following:

- (1) Were the design inputs correctly selected?
- (2) Are assumptions necessary to perform the design activity adequately described and reasonable? Where necessary, are the assumptions identified for subsequent reverifications when the detailed design activities are completed?

- (3) Was an appropriate design method used?
- (4) Were the design inputs correctly incorporated into the design?
- (5) Is the design output reasonable compared to design inputs?
- (6) Are the necessary design input and verification requirements for interfacing organizations specified in the design documents or in supporting procedures or instructions?

However, it was not apparent that the design verification process being used for Building 12-116 includes the above six steps. In addition, neither M&H nor their A/E have any procedure where structures, systems and components (SSCs) which are vital or essential to safety receive any level of design evaluation or review more rigorous than that performed for conventional SSCs.

While reviewing the application of seismic design requirements for systems and components, it was found that the organization which developed the design requirements (the A/E) was not responsible for ensuring that these requirements were implemented. For components procured for Building 12-116, this implementation was the responsibility of the Army Corp of Engineers, who is overseeing construction management. In walking down the installation of equipment in Building 12-116, it was apparent that these requirements were not implemented in areas of seismic design. (Had the organization which specified the design requirements been responsible for ensuring their implementation was subject to project management review, this should not have happened.)

7. Criterion 7: M&H Procurement:

- a. A Qualified Supplier List is currently being developed for items which have or might have a direct impact on the environment, health or safety. Suppliers are assessed using QC-1 criteria, however, DOE Order 5700.6C procurement requirements are effectively covered by QC-1. Qualification consists of a tri-annual performance-based inspection at the vendor's facilities supplemented by annual desktop reviews conducted by a certified auditor and an engineer familiar with the product.
- b. Currently, no formal system exists to feed back to the procurement organization deficiencies found for material in use. M&H management stated that such a system will be developed.
- c. The process for vendor qualification for radiac calibration was reviewed and found satisfactory. However, the vendor qualification checklist had

been "borrowed" from SANDIA National Laboratory (SNL) and was not formally approved for use at Pantex nor was it verified against DOE Order 5700.6C. (An NQA-1 based vendor qualification checklist has been drafted by the DOE Contractors Supplier Quality Information Group and proposed as the new standard for use at Pantex. This checklist was thorough.)

8. **Criterion 8: M&H Inspection and Acceptance Testing: Measuring and Test Equipment:** A metrology program is in place, with calibration standards traceable to nationally recognized standards.

9. **Criterion 9: Management Assessment:**
 - a. **AAO:** The AAO line management self-appraisal consists of:
 - (1) **AAO Technical Self-Assessment:** In this informal (i.e., without formal documentation) assessment program, technical criteria are established by the Amarillo Area Office, approved by Albuquerque, and then used by AAO for self-assessment. In support of this program, AAO technical staff is being trained in surveillance methods.
 - (2) **Area Manager's Self-Assessment:** The current plan is to form three-man performance management teams to perform vertical slice audits in areas selected by the Area Manager. The first Area Manager's Self-Assessment is planned for the fall of this year, approximately one year after the new quality program was implemented. However, this process has not yet been formalized.

 - b. **M&H:** M&H line management assessment consists of surveillance, self-assessment, management walk-throughs, the use of performance indicators and program reviews. The recently started management walk-through program requires M&H managers to spend at least ten percent of their time in this endeavor.

10. **Criterion 10: Independent Assessment**
 - a. **AAO:** The AAO surveillance program provides independent assessment of M&H and includes:

- (1) Facility representatives performing field assessments. Their field observations, along with performance indicators, occurrence reports, etc., are to be reported to an issues management board which will attempt to focus on significant issues. (The issues management board is in the process of starting up.) There is no formal closure of issues; closure is left up to the facility representatives. Field observations will be used to assess the Formality of Operations culture at Pantex.
 - (2) All AAO personnel are supposed to, though not formally required to, lay out a six-month surveillance program and spend eight hours per month on this effort. The focus of this effort is performance based reviews, not administrative compliance assessment.
- b. **M&H:** The Information Management Division Manager is responsible for the performance of the independent assessments that address the full range of activities that fall within the scope of the QA program to verify compliance with the requirements of the program and to determine its effectiveness in achieving quality. Assessors are required to be technically knowledgeable about the activities being assessed, but are independent of and do not have any direct responsibilities for those activities. M&H has an independent assessment program in place that consists of formal evaluation, a corrective action program and validation of the effectiveness of the corrective action.