



**Department of Energy**  
 Yucca Mountain Site Characterization  
 Project Office  
 P. O. Box 98608  
 Las Vegas, NV 89193-8608

WBS 1.2.11  
 QA: N/A

**MAR 17 1993**

Les E. Shephard  
 Technical Project Officer  
 for Yucca Mountain  
 Site Characterization Project  
 Sandia National Laboratories  
 P.O. Box 5800  
 Organization 6302  
 Albuquerque, NM 87185

**VERIFICATION OF CORRECTIVE ACTION AND CLOSURE OF CORRECTIVE ACTION REQUEST  
 (CAR) YM-93-022 RESULTING FROM YUCCA MOUNTAIN QUALITY ASSURANCE DIVISION  
 (YMQAD) AUDIT YMP-93-03 OF SANDIA NATIONAL LABORATORIES**

The YMQAD staff has verified the corrective action to CAR YM-93-022 and determined the results to be satisfactory. As a result, the CAR is considered closed.

If you have any questions, please contact either Robert B. Constable at (702) 794-7945 or A. Edward Cocoros at (702) 794-7242.

Richard E. Spence, Director  
 Yucca Mountain Quality Assurance Division

YMQAD:RBC-3134

Enclosure:  
 CAR YM-93-022

cc w/encl:

- ~~K. R. Hooks, NRC, Washington, DC~~
- S. W. Zimmerman, NWPO, Carson City, NV
- R. R. Richards, SNL, 6319, Albuquerque, NM
- R. L. Maudlin, MACTEC, Las Vegas, NV

cc w/o encl:

- J. H. Hines, OQD, AL
- J. W. Gilray, NRC, Las Vegas, NV
- N. J. Brogan, SAIC, Las Vegas, NV

**220133**

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 PDR WASTE  
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PDR

YMP-5

ADD: Ken Hooks

Ltr. Encl.  
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 NH03

OFFICE OF CIVILIAN  
RADIOACTIVE WASTE MANAGEMENT  
U.S. DEPARTMENT OF ENERGY  
WASHINGTON, D.C.

8 CAR NO.: YM-93-022  
DATE: 12/8/92  
SHEET: 1 OF 1  
QA

CORRECTIVE ACTION REQUEST

1 Controlling Document SNL QAIP 2-8, Revision 01		2 Related Report No. YMP-93-03	
3 Responsible Organization SNL		4 Discussed With L. Shephard/R. Richards	
5 Requirement: SNL QAIP 2-8, Revision 01, Paragraph 4.0, Step 1 states in part, "Annually and with the time interval between assessments not exceeding fifteen months, the Technical Project Officer shall initiate a management assessment by identifying team members and a team leader who...."			
6 Adverse Condition: Contrary to the above requirements, the annual management assessment for fiscal year 1991 was initiated on July 22, 1991. As of November 30, 1992, the management assessment for fiscal year 1992 has not been formally initiated, hence the fifteen months time requirement has not been satisfied.			
9 Does a significant condition adverse to quality exist? Yes ___ No <u>X</u> If Yes, Circle One: A B C		10 Does a stop work condition exist? Yes ___ No <u>X</u> ; if Yes - Attach copy of SWO If Yes, Circle One: A B C D	
		11 Response Due Date: 20 Working Days from Issuance	
12 Required Actions: <input checked="" type="checkbox"/> Remedial <input type="checkbox"/> Extent of Deficiency <input type="checkbox"/> Preclude Recurrence <input type="checkbox"/> Root Cause Determination			
13 Recommended Actions: 1. Identify the remedial action to be taken to correct the deficiencies noted in Block 6.			
7 Initiator A. E. Cocoros <i>Allee</i> Date <u>12/8/92</u>		14 Issuance Approved by: QADD <i>R. Spence</i> Date <u>12/15/92</u>	
15 Response Accepted QAR <i>Allee</i> Date <u>2/9/93</u>		16 Response Accepted QADD _____ Date _____	
17 Amended Response Accepted QAR <i>Allee</i> Date <u>2/9/93</u>		18 Amended Response Accepted QADD <i>R. Spence</i> Date <u>2/9/93</u>	
19 Corrective Actions Verified QAR <i>Allee</i> Date <u>3/9/93</u>		20 Closure Approved by: QADD <i>R. Spence</i> Date <u>3/16/93</u>	

**Response to CAR  
YM-93-022**

**1. Corrective Action Response for CAR# YM-93-022.**

**1A. Remedial Action**

The 1992 management assessment was not conducted because of a recent change in Technical Project Officers (TPO) and a misunderstanding as to when the 15-month time period ended.

The new TPO had informally commenced the assessment process as part of his project orientation; however, nothing had been formally documented.

**1A1.** The management assessment will be conducted and results documented by February 26, 1993.

**1A2.** In addition, another management assessment will be commenced by the end of the 1993 calendar year.

**1B. Investigative Action**  
N/A this CAR

**1C. Root Cause Determination**  
N/A this CAR

**1D. Corrective Action to Preclude Recurrence**  
N/A this CAR

**2. 1A1. L. E. Shephard**  
Estimated completion date — February 26, 1993

**1A2. L. E. Shephard**  
Estimated completion date — December 31, 1993

**3. Response Approved:**   
Manager, YMP Management Dept.

1/14/92  
Date

**Response to CAR  
YM-93-022**

**1. Corrective Action Response for CAR# YM-93-022.**

**1A. Remedial Action**

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The new TPO had informally commenced the assessment process as part of his project orientation; however, nothing had been formally documented.

**1A1. The management assessment will be conducted and results documented by February 26, 1993.**

**1B. Investigative Action**  
N/A this CAR

**1C. Root Cause Determination**  
N/A this CAR

**1D. Corrective Action to Preclude Recurrence**  
N/A this CAR

**2. L. E. Shephard**

**1A. Estimated completion date — February 26, 1993**

**3. Response Approved:**

*Lauren A. [Signature]*  
Manager, YMP Management Dept.

2/2/93  
Date

*Site dtd 2/2/93 - Shephard to Spencer*

OFFICE OF CIVILIAN  
RADIOACTIVE WASTE MANAGEMENT  
U.S. DEPARTMENT OF ENERGY  
WASHINGTON, D.C.

CAR NO. 17M-95-022  
DATE: 12/18/92  
PAGE: \_\_\_\_\_ OF \_\_\_\_\_  
QA

**CORRECTIVE ACTION REQUEST (Continuation Page)**

Verification of Corrective Action RE: CAR 93-022

In response to remedial action requested by CAR 93-022 the following documents were received by FAX from R. Richards, QA Manager SNL on 3/2/93

1. Letter L.E. Shepard to distribution dated 2/5/93.  
Subject: "Annual QA Assessment for Fiscal Year 1992".  
(Attachment 1)
2. Letter F.J. Schelling to Les Shephard dated 2/15/93.  
Subject : "Fiscal Year 1992 Management Assessment results and Recommendation." (Attachment 2)
3. Letter L.E. Shephard to Distribution dated 2/25/93.  
Subject: "Analysis of Management Assessment" (Attachment 3 )

An in depth review of the documents is verification that the corrective action for the CAR is considered acceptable and adequate.

It is recommended that during the next YMP QA Audit of SNL review of the results of the improvements programs requested by attachment 3 be conducted.

  
\_\_\_\_\_  
A.F. COCOROS

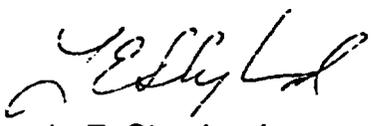
Date 3/10/93

**Sandia National Laboratories**

Albuquerque, New Mexico 87185

date: February 5, 1993

to: Distribution

from:  L. E. Shephard

subject: Annual Quality Assurance Assessment for Fiscal Year 1992

Per the instructions in QAIP 2-8, I am initiating a management assessment of the QA Program. The management assessment shall evaluate the following program aspects:

- a. Adequacy of organizational structure and staffing to implement the quality assurance program.
- b. Effectiveness of quality assurance program implementation.
- c. Adequacy of the indoctrination and training program.
- d. Adequacy of planning and procedural controls.
- e. Effectiveness of the nonconformance and corrective action system.
- f. Adequacy of the quality assurance management information tracking, evaluation, and reporting system.

In addition, the Assessment Team will make recommendations for upgrading the Quality Assurance Program to facilitate implementation by technical and project control staff.

The results will be reported by memo prior to February 15, 1993.

F.J. Schelling will be the Assessment Team Leader and sole member. His evaluation will be conducted through interviews, interactions with staff, management and Process Management Team members and through personal inspection and experience.

LES:6302/jad

DISTRIBUTION

6302 L. E. Shephard  
6312 F. W. Bingham  
6313 L. S. Costin  
6115 P. Davis  
6319 R. R. Richards  
6351 R. E. Thompson  
6352 S. E. Sharpton  
6302 90/12934/MGA/1.2/QA  
6302 YMP CRF

*Attachment 2*

Sandia National Laboratories  
Albuquerque, New Mexico 87185

WBS: 1.2.11.1

QA

date: February 15, 1993

to: Les Shephard, 6302 FEB 25 1993

from: F. J. Schelling, 6302

*F. J. Schelling*

subject: Fiscal Year 1992 Management Assessment Results and Recommendations

As requested by your February 5, 1993 memorandum and in accordance with QAIP 2-8, I have evaluated several aspects of the quality assurance (QA) program and developed a number of recommendations for upgrading the program to facilitate implementation by technical and project control staff. The attachment to this memorandum reports the results of the evaluation for your analysis and any further actions deemed necessary. Please inform me in writing of your analysis of these results as required by QAIP 2-8 so that I may complete the assessment process.

The evaluation relied heavily, as in past years, on the subjective perceptions of a number of SNL project staff. To minimize potential bias in the results, interviews were conducted with a broad sample of personnel and questions were posed in a manner designed to elicit constructive comments and improvement suggestions. For example, the adequacy of the tracking system was evaluated through interviews with staff, QA personnel, management, and those responsible for maintaining the system, each of whom bring a unique perspective to the question.

In planning the evaluation, it was considered important to review previous assessment reports and to investigate the effectiveness of follow-up actions in resolving concerns. Other actions were considered that could provide objective evidence, in addition to the subjective interviews, of the effectiveness of implementation of the QA program. Time restrictions and limited accessibility, however, prevented completing these actions for the current assessment. While subjective findings are certainly useful for determining perception, it is recommended that more objective approaches be considered for gathering data over time to support or disprove subjective observations.

A summary of the results, organized by each of the six basic program aspects evaluated and some specific recommendations are included in the attachment.

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Copy to:  
6319 R. R. Richards

90/1.2.9.11.1/1.0/QA  
YMP CRF

**Att: Fiscal Year 1992 Management Assessment Evaluation and Recommendations****Organizational Structure and Staffing Adequacy**

With one exception, there is little concern about this aspect of the program, which appears adequate. The exception is in the area of software QA, where there are indications that the current system is likely to be overwhelmed in the near future as a large number of codes are expected to be submitted for processing.

**Effectiveness of QA Program Implementation**

There is a strong perception among staff that definite improvements in this area have occurred in the past year. QA personnel appear more responsive to staff needs and the QA program seems less intrusive and more directed toward understandable goals. Staff recognize and appreciate the results of the ongoing procedural simplification effort and improvements in software QA. However, this perception is tempered by a recognition that further significant improvements are needed to gain full acceptance and effectiveness. Several individuals suggested that although we are becoming better at meeting requirements, insufficient attention is being given to the overall system, i.e., are the existing requirements suitable for our activities in addressing the underlying intent of quality assurance?

It was somewhat disturbing to note the large number of activities that are being performed outside of the QA program as "scoping" or non-quality affecting activities. This may be due in part to a recognition of resource and schedule impacts that accompany the application of QA, but there is also some confusion regarding the applicability of the QA program and QA controls appropriate to these activities. There is continued concern among staff that certain requirements and controls are misdirected, because of their power-plant based orientation, rather than being adapted to the nature of the current project. If the value added by the QA program can be demonstrated, however, there appears to be a willingness to comply with the program.

**Indoctrination/Training Program Adequacy**

This aspect of the QA program is continuing source of frustration to staff and management, for both new and more experienced personnel. Few perceive any value added by the current program, yet recognize the need for effective training in certain areas. Substantial resources were expended over the past year by the training staff to develop improvements in the system, but they await implementation before their contribution can be evaluated. There does seem to be general agreement about the limitations of the current system and the nature of needed changes. These will be discussed further as part of the recommendations given below.

(Continued)

**Planning and Procedural Control Adequacy**

Substantial improvement was recognized as a result of the procedure simplification effort and expectations are high for the usefulness of Work Agreements. Clearly, additional training and a testing period for implementation of both Work Agreements and the new grading process are needed. There continues to be some uncertainty among staff regarding which procedures apply to specific activities, and inconsistencies between the established requirements and controls appropriate to the nature of the work (i.e., "power plant" requirements are not particularly compatible with the nature of scientific investigation.). Software QA has improved over the past year, but some staff are concerned that some of the gains are being lost. Continued attention is needed to ensure that the process satisfies imposed requirements, while remaining workable, efficient, and customer-friendly.

**Nonconformance/Corrective Action Effectiveness**

These systems appear to work adequately, but are typically initiated by QA staff. A better communication of the intent of these processes and their potential benefits to technical staff could be useful. Process improvements can perhaps be made to change the perception that these systems are onerous and require considerable paperwork for little perceived value.

**QA Management Information Tracking System Adequacy**

This system is used primarily to communicate QA information between QA and management, and is viewed as one of the more informative and useful systems used on the program. The system appears to be adequately perform a useful function.

(Continued)

## Recommendations

### Training

A necessary improvement to the training system is to provide users a short summary or flowchart that identifies in an easy-to-read manner (1) what procedures exist, (2) the conditions under which each procedure should be used, and (3) the relationships between procedures. This information provides an adequate level of indoctrination, and would be useful to the experienced individual in ensuring compliance with requirements.

Requiring that procedures be "read and understood" upon joining the project or when procedures are issued is ineffective and inefficient. Value can be added, however, by providing an introductory summary (as described above), and by notifying staff via a memo of instruction upon issue of new or changed procedures. With respect to the latter, if required, verification of notification can be documented by signing and returning the instruction memo to the training staff. Requiring personnel to track down and read an official copy of a procedural revision for rarely-used procedures is particularly frustrating and could easily be overcome with a memo of instruction.

Although the situation has improved, there continues to be some mismatch between the release of a controlled document and training on it. If the current system is retained, training forms should not be distributed until the controlled document is readily available to the user.

"Point of use" training, if needed, is more effective than the current system of training on issuance, and was recommended by several members of the technical staff. If required, at the time a procedure is executed, documentation that the procedure was "read and understood" can be generated. Suggestions included signing the controlled procedure on the date of execution, or identifying the procedure number and revision date on products generated by execution of a procedure. (Additional training materials, subject area contact persons, and other process training, i.e. "performing quality affecting work," "contract procurement," "managing PACS accounts," etc., are needed to supplement "read and understand" training.)

Several staff suggested the value of technical, short-course, training in technical areas. While I agree with the value of such training, it does not seem to me the responsibility of the QA program to implement and is not clear how large the demand is for such specialized training. The possibility of obtaining standardized, modular training videotapes or posting notices of (and providing management support to) available short courses should be investigated.

(Continued)

**Planning and Procedural Controls**

A significant improvement in customer satisfaction would be gained by the elimination of ICNs. This recommendation is strongly supported by technical staff. Objective evidence shows that most ICNs are issued around the time of an audit, but have a negative impact on quality in that they make following a procedure considerably more difficult. The original intent for ICNs was to rapidly correct deficiencies that could produce quality problems if not immediately fixed, although that is rarely the situation. Rather, ICNs are typically used because they are easier to process. Particularly if procedures are kept short, to the point, and maintained on a word processing system, release of a full revision should not entail much additional time or effort. There would be some impact on document control staff responsible for preparing copies, but this is outweighed by the positive benefits to the multiple staff users. A related recommendation is to maintain a file of procedural change and improvement suggestions, evaluating the need for addressing them on a regular (perhaps annual) basis, or whenever a procedure is revised.

A number of other procedural improvements can be proposed, including removal of all extraneous material (e.g., cover pages add no value to the user); further functional grouping of procedure processes (e.g., directing procedures at specific user groups, such as is now done with QAIP 17-1 for record sources and QAIP 17-2 for records staff, or performing a systems analysis to combine procedures dealing with similar subjects), and reducing the number of forms. More dramatic changes also can be envisioned that would require a complete paradigm change, e.g., using forms and procedures only where they add value to specific processes by enhancing consistency or ensuring that requirements are adequately addressed.

(Continued)

Grading

With the introduction of the new QARD, a tremendous opportunity presents itself to greatly improve understanding, implementation, and usefulness of the QA program. This can be accomplished by a considered approach to our internal implementation of grading. Participants now have the authority to identify (or take exception to) QA requirements applicable to their overall scope of work and to apply controls commensurate with the nature of the activity.

It should be relatively straight-forward to: (1) relate our procedures to each of the associated QARD elements; (2) classify overall work scopes by their relationship to the requirements of QARD Section 2.2.3; and (3) define the QA elements applicable to an overall scope of work. Within those umbrella constraints, Work Agreements (and procedural flexibility) can be used to tailor the controls applied to specific activities to provide the most value toward assuring quality in a meaningful and workable fashion. Minimum requirements could be established, for example, for "scoping" work that would provide an adequate degree of documentation and traceability to allow the resulting information to be used in future non-scoping work. Additional controls could be specified for "quality-affecting" work that would allow the use of existing information if adequately justified; this addresses present misunderstandings that only "qualified" data can be used in "quality" work. Such interface transfers between program activities have not been adequately addressed by the program in my opinion.

For activities "subject to the QA program," it is highly important to determine the "Q-ness", e.g. what is it about an activity that justifies the application of QA controls, what the nature of the controls should be, and how rigorous to apply these controls. Management guidance and QA training may be helpful in accomplishing this in a consistent manner, while allowing implementation flexibility.

My intent in introducing Work Agreements was to use them as a work definition, planning, and authorization tool in support of a number of related objectives. These objectives include: performance measurement (in a total quality sense); adapting QA to the nature of specific work products; and for supporting project management and control functions in a matrix organization. If "Customer" requirements are adequately defined and work performed subject to these requirements, quality will be enhanced. The Work Agreement can be used for discrete, short-term work to identify applicable controls, the extent to which they are applied, the products generated under these constraints, and any changes occurring after the work is initiated. If produced in a useful format by an efficient process, Work Agreements can serve as a baseline for management and staff during the course of the work, be quite valuable in preparing for audits and surveillances, and should form the basic audit entity. That is, the work is described in the Agreement and initially subjected to QA review; as long as the activity complies with the Agreement, there should be no discrepancy or misunderstanding during follow-up audits.

(Continued)

### Project Control

I applaud and strongly support your suggestion that the QA and administrative functions place a high priority on customer service. It is certainly true that this has been the overall direction these organizations have been heading in, but additional efforts are needed.

A specific area for process improvement in my opinion are interfaces between these organizations and technical staff. We can do a better job of defining and communicating responsibilities, expectations, and accountabilities. I think many of those involved in administrative and QA work are much too busy responding to unnecessary Project and internally-imposed requirements to be able to sit back and develop improvements. This is true in numerous areas as procurement, training, document control, property inventory, monthly reporting, PACS, QA surveillances, and records management. My concern is not meant to ignore continuing improvements, particularly in records and procurement, but to recognize that more are needed.

The only solution I have is to use systems analysis techniques to define functions and necessary interface information, and then to replace current systems with more workable versions. Staff on both sides need to understand what is needed from them, how it fits into the global picture, and work together to figure out how best to effect communication. Work Agreements, if used as baselines, could be maintained as a transfer mechanism for much of this information. That is, planning information could be provided to staff for preparing Agreements; and any changes communicated to other staff by being on distribution for Agreements and changes thereto.

Management and staff should be regularly consulted on the value of the information they are provided or provide (e.g., cost reports, monthly reports), and a mechanism established for communicating and implementing suggested improvements. (This should be more active than a suggestion box to be useful.)

### Management Assessments

A final recommendation is to implement some level of ongoing management assessment processing throughout the year. Using the principles of total quality, objective statistics can be compiled for analyzing various program aspects, such as the usefulness of individual procedures, the number and variety of uses for each, problem areas in records and contracts, trends in the nature and number of quality deficiencies, overall customer satisfaction, and the effectiveness and value added by improvement actions.

*Attachment 3***Sandia National Laboratories**

Albuquerque, New Mexico 87185

date: February 25, 1993

WBS 1.2.9.11.1

to: Distribution

QA: N/A

from: L. E. Shephard, 6302 *LES*

subject: Analysis of Management Assessment

This memo analyzes and documents the results of the Management Assessment initiated February 5, 1993 and completed February 15, 1993 (see attached).

***Summary and Conclusions***

The Management Assessment Report provides several recommendations for improving the effectiveness and adequacy of the Quality Assurance (QA) Program. None of these recommendations arise from a lack of compliance with specific requirements that warrant "corrective action" as defined in QAIP 16 - 1. However, it is apparent that we must continue to improve the effectiveness of all aspects of our training program and to be diligent in our implementation of the Quality Assurance Requirements Document (QARD) so as not to undermine the significant accomplishments that have occurred in several areas over the last year. Of particular importance is the need to better communicate the importance of the planning and grading process to our technical work and to support our task leaders in taking "ownership" of this process.

Implementation of the Yucca Mountain Project (YMP) quality assurance program has improved significantly over the last year, which is a tribute to the QA and technical staff and management. However, a considerable effort is still required to fully integrate our quality assurance program into our technical program in a manner that is consistent with sound scientific and engineering practices.

***Training Program***

The training program presently implemented consists of two components: (1) training that directly supports the implementation of the quality assurance program, and (2) training that emphasizes professional development. While both of these components are essential to our mission, most of our effort (i.e., resources) has emphasized quality assurance

FEB 25 1993

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implementation, with limited remaining resources being applied to professional development. Recognizing the resource limitations, it is essential that we implement a Process Management Team (PMT) that evaluates all aspects of the training program (including those areas supporting or influencing training [e.g., document control, procedure revisions, etc.]) to improve the process and reduce costs while increasing effectiveness. The PMT will evaluate alternatives to the "read and understand" approach presently used for procedures and interim change notices (ICNs) and will develop metrics that allow an objective evaluation of the success of these efforts. All savings attributed to this effort will be "reinvested" in our staff to facilitate their continued professional development while supporting the Yucca Mountain Project.

The PMT will be organized by Scoti Hagerman. Project personnel will be assigned to the Team as necessary to effectively implement this program in a timely manner. An Action Plan will be presented to the Task Leaders and Department Managers at a time to be arranged before March 15. The Action Plan (consisting of vignettes) should contain a potential list of areas for improvement, a provisional list of metrics, potential cost savings, potential impediments to the process, and a schedule for completion. The PMT should fully consider the recommendations presented in the Management Assessment as part of their planning process.

#### *Effectiveness of QA Program Implementation*

I share the concern expressed in the Management Assessment that a large (perhaps disproportionate) number of activities within the Yucca Mountain Project are described as "scoping" activities. However, I believe this observation reflects a limited understanding by our technical staff of the grading process and the manner we apply the grading process to our work rather than a true indication that we are conducting work "outside the QA Program." The objective of the "Grading Process" is to control all work to the degree commensurate with its importance to the Project. No work funded by the YMP at Sandia is, or should be, conducted "outside of the QA Program." Project training with the task leaders and other YMP staff will be conducted by the YMP Technical Project Officer or designee to ensure all staff fully understand the basic concepts of grading and its relationship to the manner we control our technical work. This training will be continually reinforced by YMP management as new Work Agreements are developed and approved.

Although the "scoping" issue is important, it can be readily corrected with training on an individual basis. More importantly is my concern that our staff (and management!) view the QA program as an impediment to implementing standard scientific and engineering practices while conducting technical work rather than as a tool that facilitates the implementation of our technical work in a manner that can withstand the rigors of the licensing process. This issue is significantly more difficult to address but is considerably more important to the overall success of our effort.

FEB 25 1993

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Bob Richards will lead a PMT to address this issue. Specifically, the PMT will evaluate all aspects of the implementation of the QA Program, beginning with an assessment of the basic organization of the QA Department (e.g., does it satisfy all customer requirements efficiently and effectively) and the basic "business practices" implemented (e.g., are all practices focused to facilitate implementing standard scientific and engineering practices). A goal of this group will be to reduce costs related to responding to non-conformances identified in audits and surveillances while improving the quality of the QA service provided to our technical staff. An important component of this program is a well-organized QA staff that gets involved in our technical work early and often, and is highly proactive in implementing our QA Program. Prior to March 15, 1993, Bob will develop an Action Plan that identifies members of the PMT (the YMP Department Manager is one member), identifies and prioritizes the key areas of initial emphasis, identifies a list of potential metrics that will be used to judge our success, and develops a schedule that is timely and success-oriented. Bob will present the Action Plan (in vugraph format) to the Task Leaders and Department Managers prior to March 15.

#### Attachment

#### Distribution (w/attachment):

6115 P. B. Davies .  
6300 D. E. Ellis .  
6312 F. W. Bingham .  
6313 L. S. Costin .  
6319 R. R. Richards ✓  
6351 R. E. Thompson .  
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6352 90/1.2.9.11.1/1.0/QA .  
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