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U.S. ARMY
MATERIEL COMMAND

TEST TECHNOLOGY DEVELOPMENT

FINAL REPORT

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO) 9000 AND CHEMICAL AGENT STANDARD ANALYTICAL REFERENCE MATERIAL (CASARM) QUALITY SYSTEM DEVELOPMENT AND IMPLEMENTATION PHASE I

By

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Quality Management Office
Office of the Technical Director

U.S. ARMY DUGWAY PROVING GROUND
DUGWAY, UT 84022-5000

SEPTEMBER 1994

Prepared for:
Commander
U.S. Army Test and Evaluation
Command ATTN: AMSTE-CT-T
Aberdeen Proving Ground, MD
21005-5055

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Command Aberdeen Proving Ground,
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ABERDEEN PROVING GROUND, MARYLAND 21005-5055

REPLY TO ATTENTION OF

AMSTE-CT-T (70-10p) 16 Aug 94

MEMORANDUM FOR Commander, U.S. Army Dugway Proving Ground, ATTN: STEDP-TD-Q, Dugway, UT 84022-5000

SUBJECT: Test Technology Development Final Report, International Organization for Standardization (ISO) 9000 and Chemical Agent Standard Analytical Reference Material (CASARM) Quality System Development and Implementation, Phase I, TECOM Project 7-CO-M93-DPD-012

1. Subject report is approved.

2. Point of contact at this headquarters is Mr. Donald J. Lacey, AMSTE-CT-T, amstectt@apg-9.apg.army.mil, DSN 298-1480.

FOR THE COMMANDER:

FREDERICK D. DABANTA
Chief, Tech Dev Div
Directorate for Corporate Information
and Technology

REPORT DOCUMENTATION PAGE

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13. ABSTRACT *(Maximum 200 words)*

U.S. Army Dugway Proving Ground (DPG) is in the process of developing an International Organization for Standardization (ISO) 9000 quality assurance (QA) system and a Chemical Agent Standard Analytical Reference Material (CASARM) QA program. Phase I of this process consisted of analyzing the current DPG QA system, defining the structure of the new QA system, determine how the ISO 9000 and the CASARM systems will interact, develop the new QA system and implementation plan, and develop the CASARM program and begin implementation.

The initial phases of the system design and synthesis met the objectives established for Phase I of this methodology project. Phase II will complete the functional analysis, system design, and prototype implementation. The prototype will be analyzed for weaknesses in operation, personnel and equipment requirements, software, and cost effectiveness. The system will be modified, if needed, and implemented across the Materiel Test Directorate. The final stage of this methodology will be to achieve ISO 9000 registration.

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17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
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SECTION 1. SUMMARY

1.1 BACKGROUND

The International Organization for Standardization (ISO) is a worldwide federation for preparing national standards on quality assurance (QA). The preparation of International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, take part in the work. ISO Technical Committee 176 developed the ISO 9000 series of standards (Reference 1).

In December 1986, the ISO published the first edition of *Guidelines for Third Party Assessment and Registration of a Supplier's Quality System, Guide 48* (Reference 2). This document laid the ground work for the traumatic change that was about to take place in the quality community. In 1987, the ISO 9000 series was released. It quickly became apparent that to have a credible system in the European arena, the ISO 9000 standards must be met. The United Kingdom quickly released British Standards Institute (BSI) BS5750: Part 0.1: 1987 (Reference 3). The BSI series is closely akin to the ISO standards and requires the same quality system for conformance. The European Free Trade Association (EFTA) also made alliances with ISO, conveying to the world that Europe was uniting under the ISO standards. In the United States, the American Society for Quality Control (ASQC) and the American National Standards Institute (ANSI) produced a set of documents (Q90-1987 series) for American companies that would align their policies with the European standards. The Q90 series reflects the ISO 9000 series almost exactly in clearer and more concise language (Reference 4).

The ISO 9000/Q90 series of standards have rapidly gained recognition as the accepted QA standards. The U.S. government and industries must conform to these standards to be credible in the European arena.

1.2 PROBLEM

U.S. Army Dugway Proving Ground (DPG), Utah, is extensively involved in Chemical Warfare Convention (CWC) verification testing. This involvement will be increasing to include laboratory analysis of samples collected in support of CWC verification and recommendations to the Technical Secretariat for Certification (as independent evaluators in an international setting) of equipment and procedures. This level of testing requires that our data be fully accepted as quality data by the European community. The ISO 9000 quality system is the world standard QA system (Figure 1). The present DPG QA system does not conform to ISO 9000/Q90 standards. In order for DPG to continue its growing role in the international CWC verification program, a DPG ISO 9000 QA system must be developed and implemented.

COUNTRIES ADOPTING ISO 9000 STANDARDS AS THE NATIONAL STANDARD

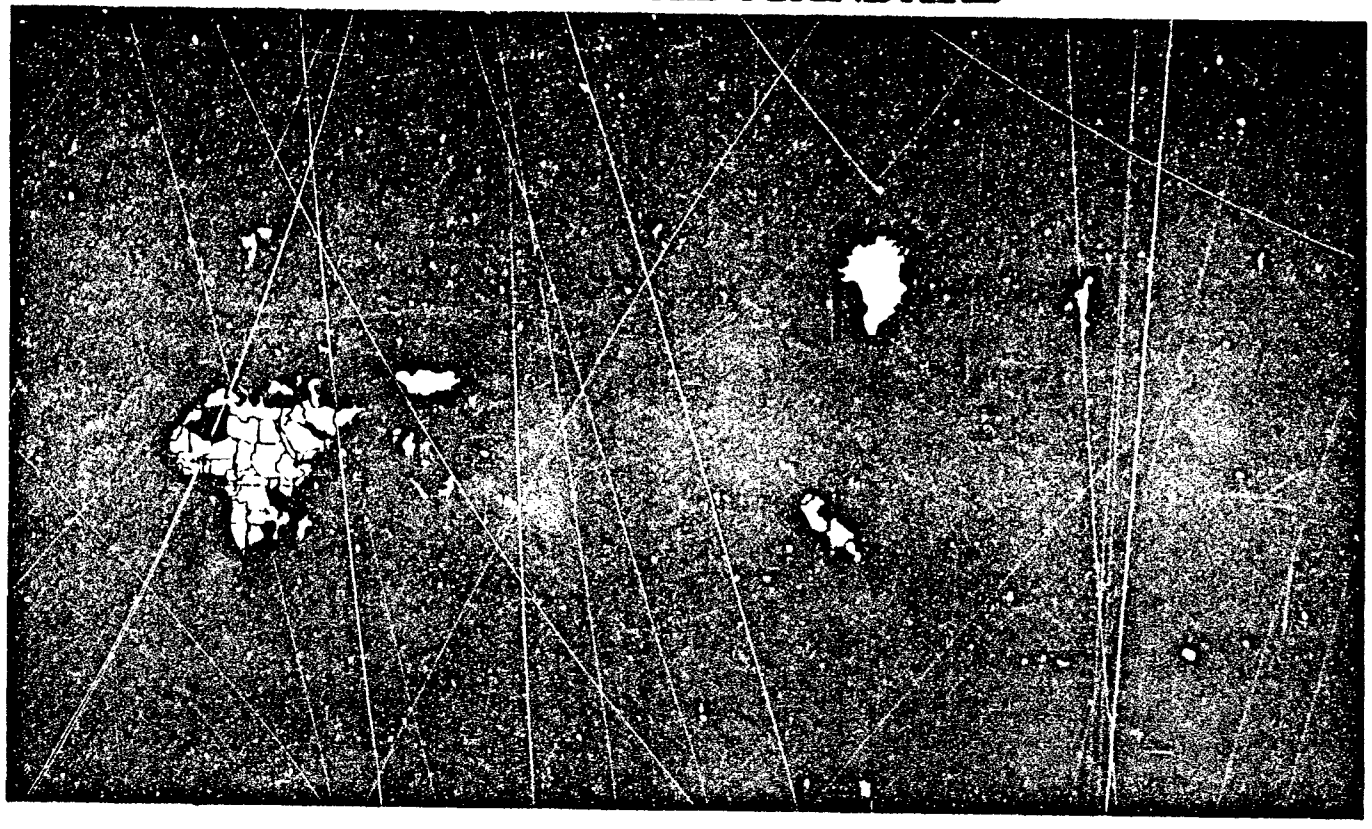

Figure 1. International Standards Organization (ISO) 9000 Global Usage*; DPG ISO and CASARM Quality System Development and Implementation, Phase I.

*All countries in red have adopted ISO 9000 standards as national standards.

DPG is also required to participate in the Chemical Agent Standard Analytical Reference Material (CASARM) QA program (Reference 5) by U.S. Department of the Army Pamphlet (DA PAM) 385-61, Army Toxic Chemical Agent Safety Program (Reference 6). The objectives of the CASARM QA plan are to establish standard laboratory practices and procedures and provide a consistent framework for the generation of analytical data in support of agent monitoring activities by the U.S. Army and government contractors. The CASARM QA system conforms to ISO 9000 standards. The present DPG chemical safety air monitoring program does not meet CASARM/ISO 9000 standards. A system that conforms to these standards must be developed and implemented.

1.3 OBJECTIVES

a. Determine the shape of the new QA system.

b. Determine how the overall ISO 9000 and CASARM systems would interact with each other.

c. Develop the new QA system and its implementation plan.

d. Develop CASARM program and begin implementation.

1.4 PROCEDURES

A system analysis was conducted on the present QA system. The results were analyzed and used to establish a conceptual QA system design. This "strawman" was designed with a flexible structure to allow for the pending DPG Materiel Test Directorate reorganization, including changes in management, overall organization, and test conduct structure.

A further subanalysis of the system looked at different ways of structuring CASARM regarding the conceptual ISO systems. Although CASARM follows ISO 9000 standards closely, with only minor deviations, the second analysis confirmed that CASARM and ISO 9000 systems would function best if CASARM was under the umbrella of the overall ISO system. A separate CASARM manual which will define the program will be written.

A working group was established to brainstorm the development and implementation of the strawman QA and CASARM system. The group analyzed the following:

a. Allocation of requirements (boundaries and constraints).

b. Trade-off and optimization.

c. Synthesis and definition.

1.5 RESULTS

1.5.1 Initial System Analysis

1.5.1.1 General

The system analysis revealed existing weaknesses in the present QA system, including ineffective management tracking of critical milestones, documentation of data flow, corrective action procedures, and documentation control. However, the present system is not totally without merit and will provide an adequate foundation for the strawman QA system.

The strawman QA system was designed as a "living system", with inherent flexibility to handle changes in management, overall organization, and test conduct structure. The system will define, establish, implement, and audit the 20 quality system requirements of ISO 9001 (Reference 7). These requirements are as follows:

a. Management responsibility.

b. Quality system.

c. Contract review.

d. Design control.

e. Document control.

f. Purchasing.

g. Purchaser supplied product.

h. Product identification and traceability.

i. Process control.

j. Inspection and testing.

k. Inspection of measuring and test equipment.

l. Inspection and test status.

m. Control of nonconforming product.

n. Corrective action.

o. Handling, storage, packaging, and delivery.

p. Quality records.

q. Internal quality audits.

r. Training.

s. Servicing.

t. Statistical techniques.

1.5.1.2 Cornerstones of the Strawman Quality Assurance (QA) System. The QA system (Figures 2 and 3) is built on clear, concise information flow; a well defined documentation control procedure; and a clear corrective action process. It is divided into three levels: the overall system, the divisional QA/quality control (QC) system, and individual test QA/QC systems. The CASARM system is part of the chemical test QA/QC system. The QA system as a whole is dependent on the proper functioning of the different levels and subsystems.

a. Clear, concise information flow. Clear, concise information flow is essential for the smooth functioning of any system. Figure 4 outlines the information flow pattern for the developing QA system. The red arrows represent the formal communication routes, and the green arrows represent the informal communication flow. The informal communication flow is just as essential as the formal. Informal communication allows for discussions, debate, and idea sharing with peers, scientists, and other experts in the area of interest.

b. Documentation control procedure. All systems need to be clearly defined as to what they are to accomplish, how they are to accomplish it, and when it will be accomplished. A well defined documentation control procedure will satisfy all of these requirements. This procedure will clearly define how all test plans and reports, standing operating procedures (SOPs), QA/QC plans, and data will be documented, approved, changed/modified, and traced. Two systems are currently under consideration: a centralized document control data base and a decentralized document control data base. Figure 5 depicts a centralized document control data base, where documents are generated by personnel in individual divisions and then follow an approval progression (denoted by the red arrows) to the appropriate level. Once the document is approved, it will be entered into the data base under the appropriate directory (i.e., chemical SOPs, test plans, test reports, etc.) by the Quality Manager's Office. This office has the only write ability, all others may read and copy. Figure 6 represents the decentralized document control data base. With this scheme, the issuing division will keep the controlled document and a register of who has copies of it. With both document control procedures, the approval procedures are the same, the issuing organization is responsible for notification of changes/modifications to documents, and the users are responsible for updating their copies.

c. Corrective action process. The corrective action process provides the system oversight. This mechanism ensures that the system has been implemented and is accomplishing

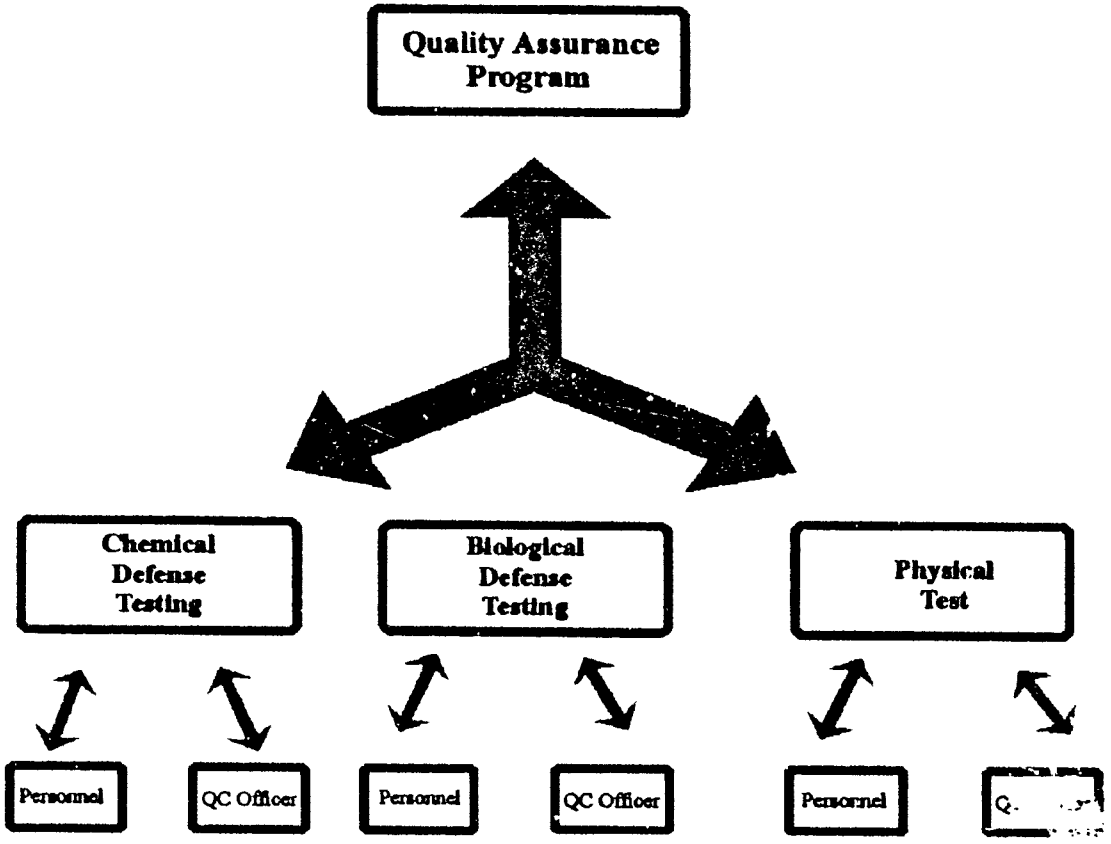

Figure 2. Quality Assurance (QA); DPG ISO 9000 and CASARM Quality System Development and Implementation, Phase I.

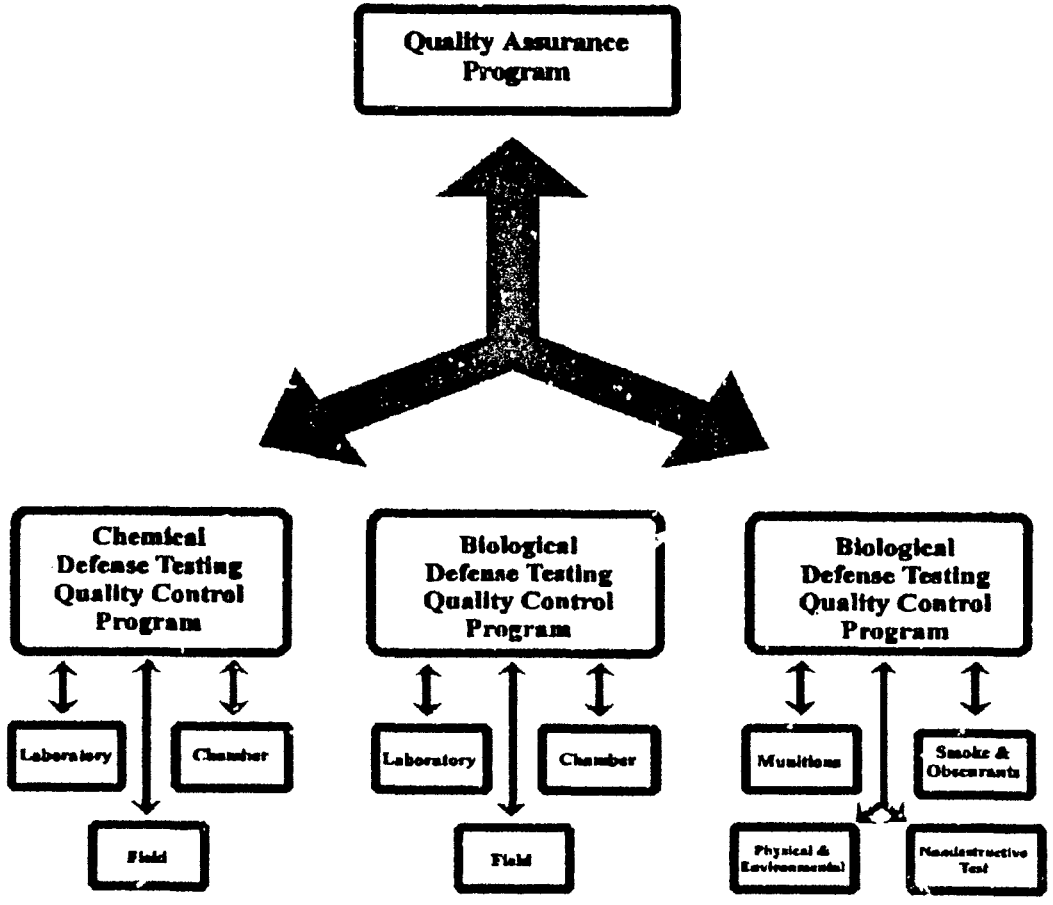

Figure 3. Quality Assurance (QA) System Structure: DPG ISO 9000 and CASARM Quality System Development and Implementation, Phase I.

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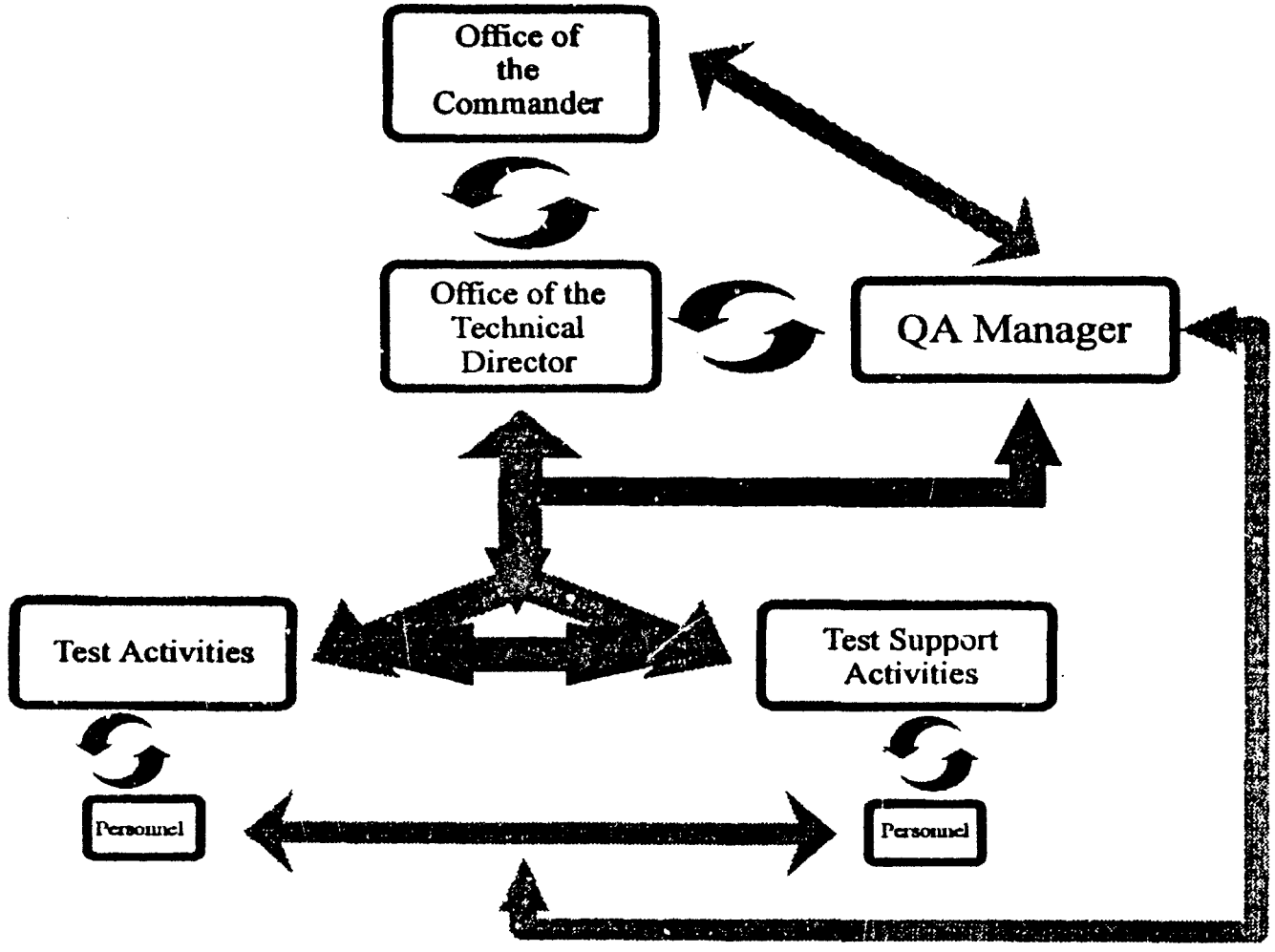

Figure 4. Information Flow Pattern for Quality Assurance (QA) System; DPG ISO 9000 and CASARM Quality System Development and Implementation, Phase I.

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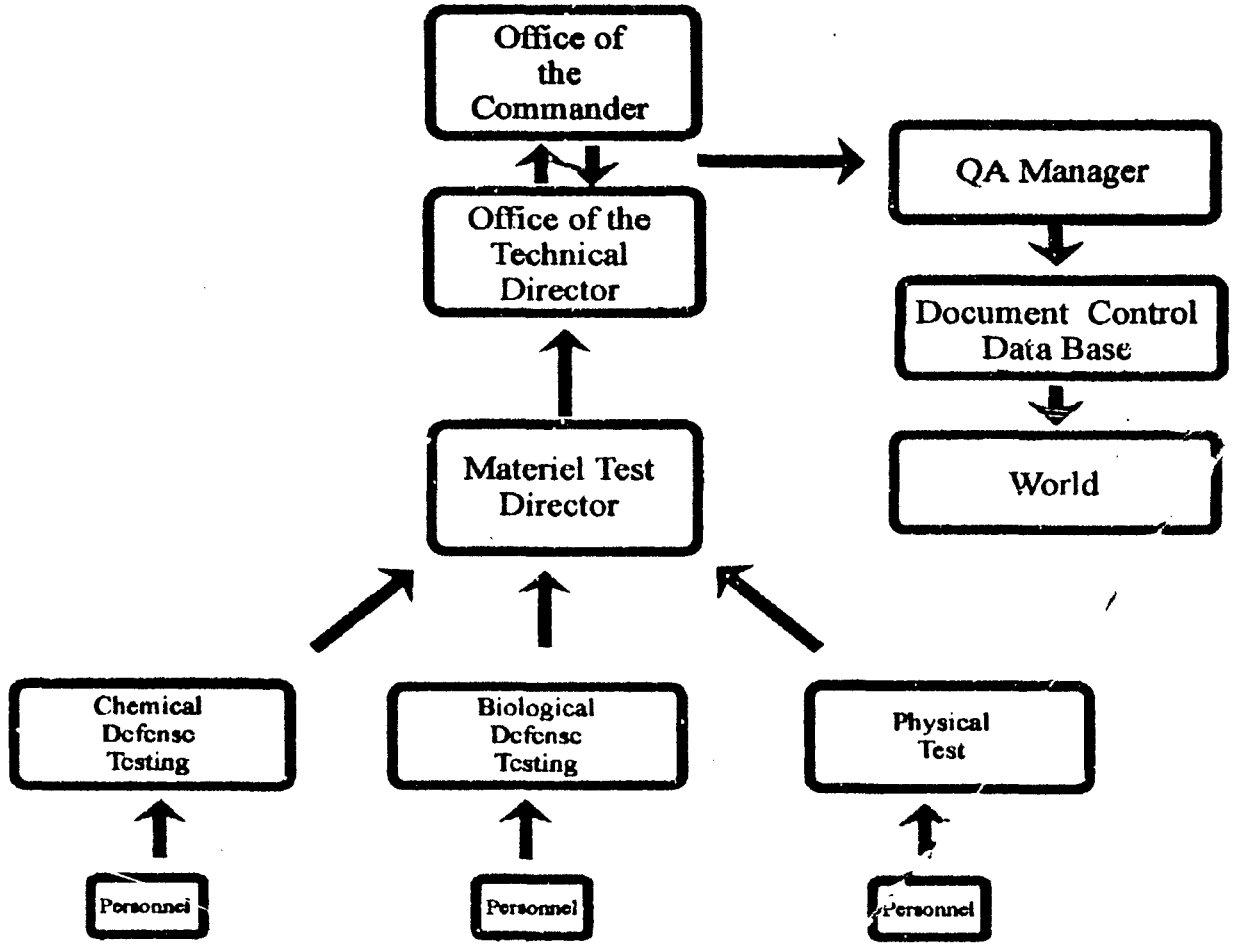

Figure 5. Document Control System 1; DPG ISO 9000 and CASARM Quality System Development and Implementation, Phase I.

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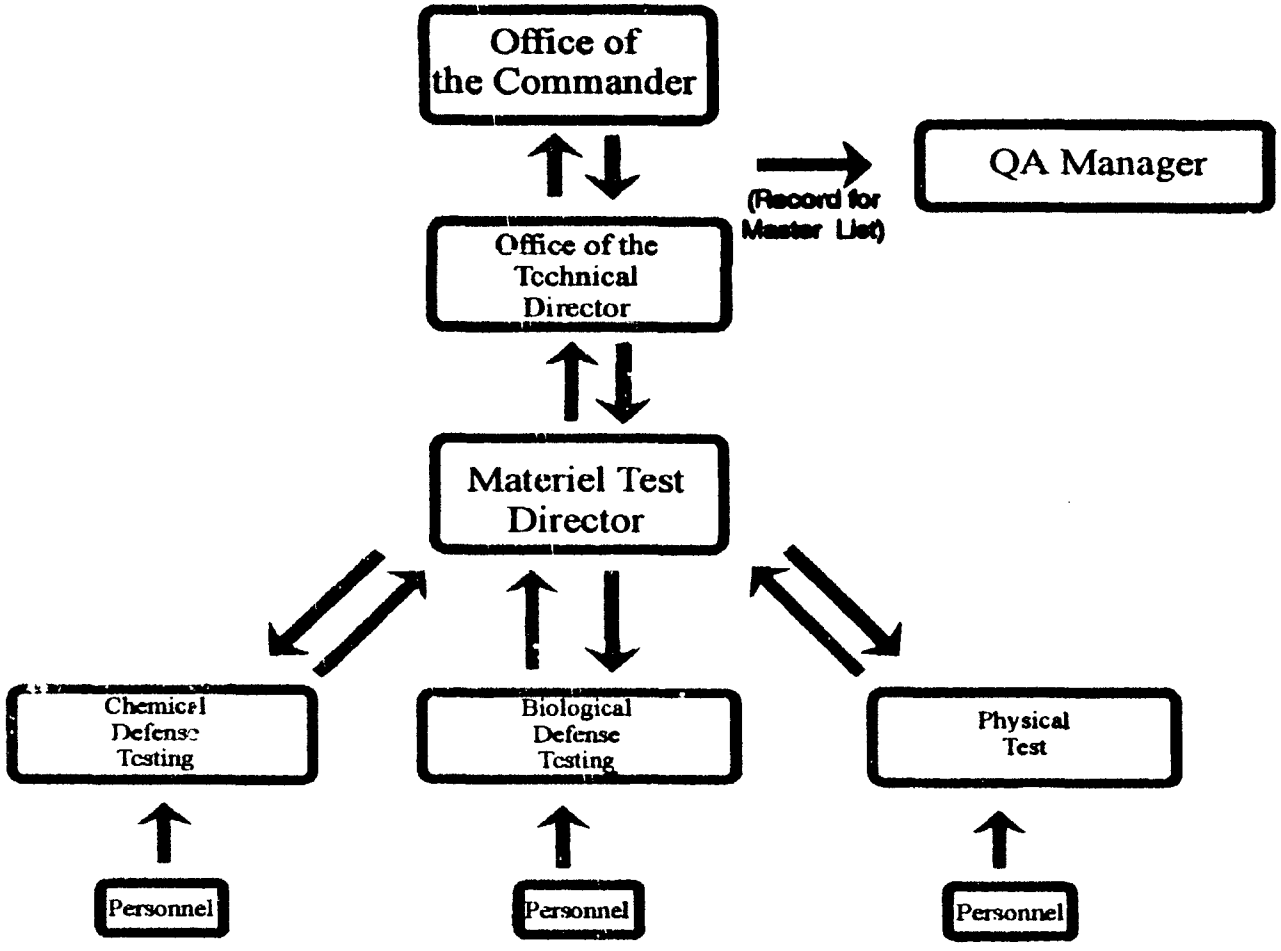

Figure 6. Document Control System 2; DPG ISO 9000 and CASARM Quality System Development and Implementation, Phase I.

its objectives. Figure 7 represents the corrective action process for the purposed QA system. The red arrows represent the formal flow of corrective action reports (CARs) resulting from an audit or problems in data flow, testing procedures, etc. The purpose of a CAR is to ensure that any problem that arises is properly documented and followed through until the point of correction. The green arrows represent the informal corrective action process. Like the informal communication flow, the informal corrective action flow allows for discussion of the problem among peers, topic experts, scientists, and engineers.

1.5.2 Chemical Agent Standard Analytical Reference Material (CASARM) Program

The CASARM program is an ISO 9000 registered program (Appendix A). During the development of the strawman QA, it became obvious that CASARM should be run under the ISO system. CASARM requirements are identical to ISO requirements, and it would be much easier to manage one system with different components than to manage two completely separate systems. One system management will save on manpower, cost, and time spent executing the program's requirements.

Due to the complexity of the CASARM system, a separate CASARM Manual was written which covers in detail the specific CASARM requirements. The number one priority of the CASARM program is the required precision and accuracy (P&A) studies which must be conducted on all instruments used for air safety monitoring. During the initial system analysis of the QA system, the CASARM P&A program was developed and implementation started.

1.5.3 General

Implementation of an across-the-board ISO QA system is not likely to succeed. Due to the diverse nature of DPG testing, subsystems must be developed for each laboratory and test type (Figure 3). The subsystems would be developed and implemented so that they would link efficiently with each other to form the complete system.

The system's structure and operation will be a flattened hierarchy (the system will be wider than it is tall). There will be only two layers of management oversight, and each layer will have a wide area of responsibility (Figure 3).

1.6 RECOMMENDATIONS

The initial phases of the system design and synthesis met the objectives established for Phase I of this methodology project. Phase II will complete the functional analysis, system design, and prototype implementation. The prototype will be analyzed for weaknesses in operation, personnel and equipment requirements, software, and cost effectiveness. The system will be modified, if needed, and implemented across the Materiel Test Directorate. The final stage of this methodology will be to achieve ISO 9000 registration.

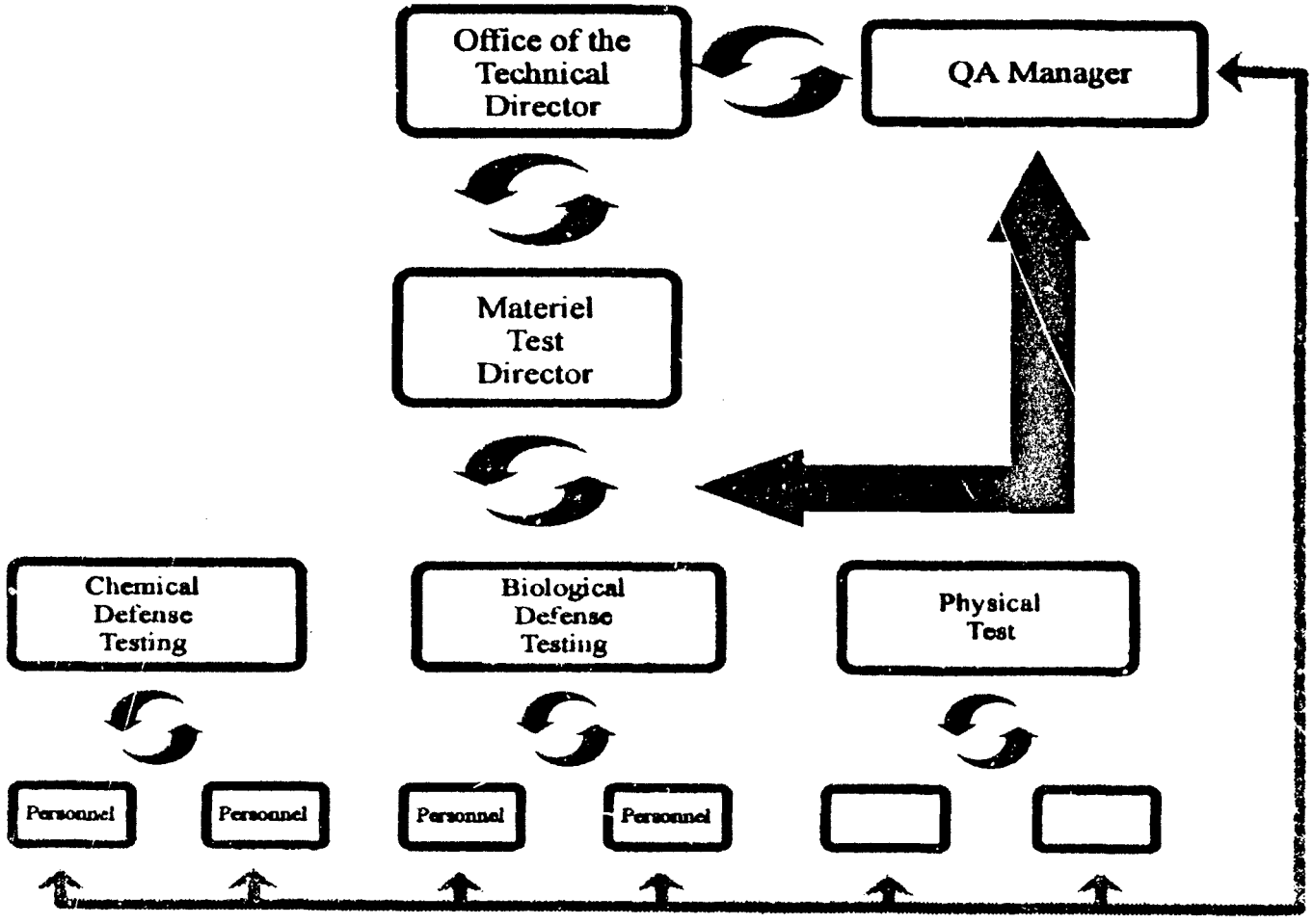

Figure 7. Corrective Action Flow; DPG ISO 9000 and CASARM Quality System Development and Implementation, Phase I.

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SECTION 2. QUALITY ASSURANCE (QA) SYSTEM TESTING

2.1 PROCEDURES

2.1.1 Conceptual System Design

An analysis was conducted to clearly define the need (in terms of the existing deficiency), the urgency, the magnitude of resources available, and the relative priority of the new QA system's capabilities. In addition, a feasibility analysis was conducted to determine the best technical approach to be applied in the new system's development.

Results from the analysis of need and feasibility analysis were used for determining parameters in establishing system design. The system's operational requirements were clearly defined during this phase.

2.1.2 Functional Analysis

The functional analysis served as a basis for the identification of design requirements for each hierarchical level of the system. A function constitutes a specific or discrete action required to achieve a given objective. The functional analysis ensured that:

a. All facets of system development, operation, and support are covered.

b. All elements of the system are fully recognized and defined.

c. The proper sequences and design relationships are established, along with critical design interfaces. These serve as a baseline for the definition of later equipment requirements, personnel requirements, software requirements, etc. (Reference 8).

2.1.3 Preliminary System Design

Translation of the system's operational requirements into specific design criteria for various elements of the system took place during the preliminary system design phase.

2.1.3.1 Allocation of Requirements. The distribution and allotment of top-level requirements to the subsystem will be analyzed in Phase II of this methodology by considering all appropriate qualitative and quantitative criteria that would influence the system. The allocation parameters established during Phase I included system support, effectiveness, capability, and performance.

2.1.3.2 Trade-off and Optimization. Trade-off and optimization will consist of identification of alternative system configurations, evaluation of criteria, and the basis for the analyses. The various alternatives will be evaluated on an equivalent basis in Phase II.

2.1.3.3 Synthesis and Definition. The different testing functions were reviewed to locate the best arena for the development and implementation of the preliminary QA system model.

2.1.4 Chemical Agent Standard Analytical Reference Material (CASARM) Development

Development of the CASARM QC Plan proceeded independent of the QA system development. Although it incorporated the same design steps and philosophies as the entire QA system, CASARM development followed an accelerated time line due to the urgency of fulfilling DA PAM 385-61 requirements as soon as possible. At each phase of development, CASARM was checked to ensure that it operated smoothly under the ISO 9000 program.

A working draft of the CASARM QC Plan was published, and all groups involved started working under its guidance. CASARM projects included, but were not limited to, the development and conduct of P&A studies on all air safety monitoring instrumentation, implementation of a data traceability system that met CASARM requirements, operator certification, development of required 40-year data bases, development and implementation of internal and external audit systems, and a document control system.

2.2 ANALYSIS

2.2.1 Conceptual System Design

A decision matrix (Table 1), addressing existing deficiencies, their urgency, and the magnitude of the resources required to eliminate the deficiency, was developed by the working group. The urgency and resource categories were rated from one to ten, with ten having the highest urgency and resource demand.

2.2.2 Functional Analysis

Each existing deficiency was broken down into specific actions required to eliminate it (Table 2).

2.2.3 Preliminary System Design

2.2.3.1 Allocation of Requirements. The parameters (system support, effectiveness, and capability) for each deficiency action are being established.

2.2.3.2 Trade-off and Optimization. Three different QA system configurations are currently being studied: a centralized management system, a decentralized management system, and a combination of these two systems. Each system is being evaluated as to its ability to meet the following criteria:

a. Implementation ease.

b. Information flow.

Table 1. Conceptual System Design Decision Matrix; DPG ISO 9000 and CASARM Quality System Development and Implementation, Phase I.

DEFICIENCIES	URGENCY[a]	RESOURCES REQUIRED[a]
Quality policy understood, implemented, and maintained at all levels in the organization.	7	3
Responsibility and authority clearly defined, as it relates to quality.	9	6
Formal management review process.	7	5
Internal and external customer contract review process.	5	8
Formal design review process.	5	8
Document control.	10	10
Formal verification of purchased items.	4	4
Quality control.	10	10
Calibration.	10	7
Data traceability.	10	8
Control of nonconforming data.	10	7
Corrective action process.	7	9
Quality records.	7	9
Internal quality audits.	6	5

[a]10 = highest urgency/resource demand.

Table 2. Deficiencies/Required Actions Break-Down; DPG ISO 9000 and CASARM Quality System Development and Implementation, Phase I.

DEFICIENCY	REQUIRED ACTION
Quality policy understood, implemented, and maintained at all organizational levels.	1. Review and rewrite quality policy. 2. Communicate new policy to work force. 3. Make policy easily available.
Responsibility and authority clearly defined, as they relate to quality.	1. Flow chart quality decision process. 2. Define quality responsibilities and authorities for all levels. 3. Communicate responsibility and authority to all organization levels. 4. Implement quality authority chain.
Formal management review process.	1. Flow chart current management review process. 2. Identify shortcomings. 3. Rework system to solve shortcomings. 4. Flow chart new system. 5. Check continuity of new system. 6. Document new process. 7. Communicate process to work force. 8. Implementation.
Internal and external customer contract review process.	1. Flow chart current review process. 2. Identify shortcomings. 3. Rework system to solve shortcomings. 4. Flow chart new system. 5. Check continuity of new system. 6. Document new process. 7. Communicate process to work force. 8. Implementation.

Table 2. Deficiencies/Required Actions Break-Down; DPC ISO 9000 and CASARM Quality System Development and Implementation, Phase I (Cont'd).

DEFICIENCY	REQUIRED ACTION
Formal design review process.	1. Flow chart current review process. 2. Identify shortcomings. 3. Rework system to solve shortcomings. 4. Flow chart new system. 5. Check continuity of new system. 6. Document new process. 7. Communicate process to work force. 8. Implementation.
Document control.	1. Flow chart proposed system. 2. Analyze new system for shortcomings. 3. Rework process to solve shortcomings. 4. Flow chart revised system. 5. Check continuity of revised system. 6. Document system. 7. Communicate system to work force. 8. Implementation.
Formal verification of purchased items.	1. Flow chart current verification process. 2. Identify shortcomings. 3. Rework system to solve shortcomings. 4. Flow chart new system. 5. Check continuity of new system. 6. Document new process. 7. Communicate process to work force. 8. Implementation.
Quality control.	1. Flow chart current quality control process. 2. Identify shortcomings. 3. Rework system to solve shortcomings. 4. Flow chart new system 5. Check continuity of new system. 6. Document new process. 7. Communicate process to work force. 8. Implementation.

Table 2. Deficiencies/Required Actions Break-Down; DPG ISO 9000 and CASARM Quality System Development and Implementation, Phase I (Cont'd).

DEFICIENCY	REQUIRED ACTION
Calibration.	1. Flow chart current calibration process. 2. Identify shortcomings. 3. Rework system to solve shortcomings. 4. Flow chart new system. 5. Check continuity of new system. 6. Document new process. 7. Communicate process to work force. 8. Implementation.
Data traceability.	1. Flow chart current data traceability process. 2. Identify shortcomings. 3. Rework system to solve shortcomings. 4. Flow chart new system. 5. Check continuity of new system. 6. Document new process. 7. Communicate process to work force. 8. Implementation.
Control of nonconforming data.	1. Flow chart current process. 2. Identify shortcomings. 3. Rework system to solve shortcomings. 4. Flow chart new system. 5. Check continuity of new system. 6. Document new process. 7. Communicate process to work force. 8. Implementation.
Corrective action process.	1. Flow chart current corrective action process. 2. Identify shortcomings. 3. Rework system to solve shortcomings. 4. Flow chart new system. 5. Check continuity of new system. 6. Document new process. 7. Communicate process to work force. 8. Implementation.

Table 2. Deficiencies/Required Actions Break-Down; DPG ISO 9000 and CASARM Quality System Development and Implementation, Phase I (Cont'd).

DEFICIENCY	REQUIRED ACTION
Quality records.	1. Flow chart proposed system. 2. Analyze new system for shortcomings. 3. Rework process to solve shortcomings. 4. Flow chart revised system. 5. Check continuity of revised system. 6. Document system. 7. Communicate system to work force. 8. Implementation.
Internal quality audits.	1. Flow chart proposed system. 2. Analyze new system for shortcomings. 3. Rework process to solve shortcomings. 4. Flow chart revised system. 5. Check continuity of revised system. 6. Document system. 7. Communicate system to work force. 8. Implementation.

c. Manageability.

d. Cost effectiveness.

e. Overall effectiveness.

2.2.3.3 Synthesis and Definition. Each testing function is being analyzed for the following:

a. Level of QA/QC activity present.

b. Customer satisfaction.

c. Workload.

d. Need.

2.3 RESULTS

2.3.1 Conceptual System Design

Document control and QC have the highest urgency and manpower requirements. Implementation and/or reworking of these areas will stress the system the most. The design of the new QA system will take this into account by allowing for flexibility and ease of implementation and use.

Calibration, data traceability, and control of nonconforming data also rated high in urgency and resource requirements. The implementation of a document control system and the upgrade of the present QC systems will improve these areas.

2.3.2 QA System Functional Analysis

The functional analysis established the required actions for each area of deficiency (Table 2). Currently, each item in Table 2 is being addressed and is at a different stage of the development cycle. Finalization of this stage of the methodology will occur early in Phase II.

2.3.3 Preliminary System Design

Allocation of requirements, trade-off and optimization, and synthesis and definition are still under design and will be started early in Phase II.

2.3.4 Chemical Agent Standard Analytical Reference Material (CASARM)

A strawman CASARM program was implemented with the largest benefit being the development and implementation of the P&A program for the Miniature Automatic Continuous Air Monitoring Systems® (MINICAMS®).

SECTION 3. APPENDICES

APPENDIX A. METHODOLOGY DIRECTIVE

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005-5055

REPLY TO ATTENTION OF

AMSTE-TC-D (70-10p) 12 Apr [illegible]

MEMORANDUM FOR Commander, U.S. Army Dugway Proving Ground,
ATTN: STEDP-MT-A, Dugway Proving Ground, UT
84022-5202

SUBJECT: Amendment 4 to Test Execution Directive, Test Technology Development Program

1. References:

a. Memo, HQ TECOM, AMSTE-TC-D, 30 Sep 92, subject: Test Execution Directive, Test Technology Development Program.

b. Memo, USADPG, STEDP-MT, 6 Apr 93, subject: Reallocation of DPG Technology Funds.

2. This memo, with list of investigations at encl 1, amends reference 1a, as requested in reference 1b.

3. Point of contact at this headquarters is Ms. Cynthia McMullen, AMSTE-TC, amstetcd@apg-9.apg.army.mil, DSN 298-1469.

FOR THE COMMANDER:

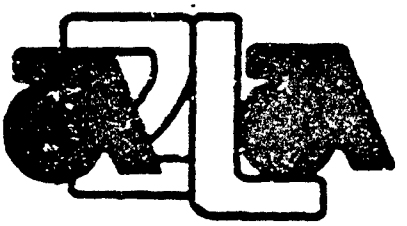
Kenneth Ballist

Encl

KENNETH R. BALLIET
Acting Chief, Tech Dev Div
Directorate for Technology

CF (w/encl):
Cdr, USADPG, ATTN: STEDP-MT-AT (Perry Pederson)

APPENDIX B. CASARM/ISO REGISTRATION CERTIFICATE



THE AMERICAN
ASSOCIATION FOR
LABORATORY
ACCREDITATION

REGISTERED QUALITY SYSTEM

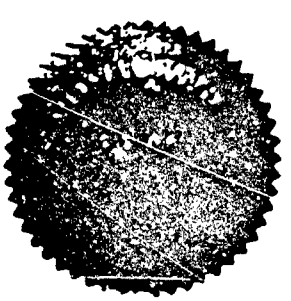
Through the Registration Committee of its Accreditation Council, A2LA has registered the Quality System of

U.S. ARMY ERDEC CASARM
QUALITY ASSURANCE PROGRAM
Aberdeen Proving Ground, Maryland

This Quality System meets the requirements of

ASQC Q92 (ISO 9002) standard for the production and distribution of neat and synthetic chemical agent standard analytical reference material and provision by the CASARM Quality Assurance Branch of related quality assurance services.

Presented this 7th day of March 1994



John W. Locke
President
For the Accreditation Council

Certificate Number R-005

Valid to January 31, 1995

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APPENDIX D. ABBREVIATIONS

ANSI - American National Standards

ASQC - American Society for Quality Control

BSI - British Standards Institute

CWC - Chemical Warfare Convention

CAR - corrective action report

CASARM - Chemical Agent Standard Analytical Reference Material

DA PAM - U.S. Department of the Army Pamphlet

DPG - U.S. Army Dugway Proving Ground

EFTA - European Free Trade Association

ISO - International Organization for Standardization

P&A - precision and accuracy

QA - quality assurance

QC - quality control

SOP - standing operating procedure

APPENDIX E. DISTRIBUTION LIST

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