

**O-S-809E**

November 16, 1990

**SUPERSEDING**

O-S-00809D (ARMY-EA)

May 29, 1990

O-S-809C

February 16, 1984

**FEDERAL SPECIFICATION**  
**SULFURIC ACID, TECHNICAL**

*This specification is approved by the Commissioner of Federal Supply Service, General Services Administration, for use by all Federal agencies.*

**1. SCOPE**

**1.1 Scope.** This specification covers two types and two classes of technical grade sulfuric acid.

**1.2 Classification.** Sulfuric acid shall be of the following types and classes as specified (see 6.2):

Type I - 66° Baumé

Type II - 60° Baumé

Class 1 - For galvanizing and plating

Class 2 - For general use

Comments or suggestions pertaining to this specification should be addressed to:  
Commander, U.S. Army Chemical Research, Development and Engineering Center,  
ATTN: SMCCR-PET-S, Aberdeen Proving Ground, MD 21010-5423

FSC 6810

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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## 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein:

### Federal Specifications:

- L-P-390 - Plastic, Molding and Extrusion Material Polyethylene and Copolymers (Low, Medium, and High Density)
- NN-P-71 - Pallets, Material Handling, Wood, Stringer Construction, 2-Way and 4-Way (Partial)
- PPP-C-96 - Cans, Metal, 28 Gauge and Lighter
- PPP-C-186 - Containers, Packaging and Packing for Drugs, Chemicals, and Pharmaceuticals
- PPP-T-66 - Tape, Packaging, Vinyl Plastic Film

### Federal Standards:

- Fed. Std. No. 123 - Marking for Shipment (Civil Agencies)
- FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to the Government

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under **General Information in the Index of Federal Specifications, Standards and Commercial Item Descriptions**. The **Index**, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification, other Federal specifications, and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston, MA; New York, NY; Washington, DC; Philadelphia, PA; Atlanta, GA; Chicago, IL; Kansas City, MO; Fort Worth, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; and Auburn, WA.

(Federal Government activities may obtain copies of Federal standardization documents and the **Index of Federal Specifications, Standards and Commercial Item Descriptions** from established distribution points in their agencies.)

### Military Standards:

- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-147 - Palletized Unit Loads

(Copies of military specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

**Code of Federal Regulations (CFR):**

- 29 CFR 1910.1200 – Occupational Safety and Health Standard on Hazard Communication
- 49 CFR 171 to 199 – Hazardous Materials Regulations

(The Code of Federal Regulations and the Federal Register (FR) are for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

**2.2 Other publications.** The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

**International Civil Aviation Organization**

“Technical Instructions for the Safe Transport of Dangerous Goods by Air”

(Application for copies should be addressed to the International Civil Aviation Organization, 1000 Sherbrooke Street West, Suite 400, Montreal, Quebec, Canada H3A 2R2)

**International Maritime Organization**

“International Maritime Dangerous Goods Code”

(Application for copies should be addressed to the International Maritime Organization, 101-104 Piccadilly, London, W1V 0AE, England.)

**ASTM Standards:**

- C 516 – Vermiculite Loose Fill Thermal Insulation
- E 223 – Analysis of Sulfuric Acid

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

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**2.3 Order of precedence.** In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

**3.1 Appearance.** Sulfuric acid shall be an oily, clear to slightly cloudy liquid when tested as specified in 4.2.4.1.

**3.2 Chemical and physical characteristics.** Sulfuric acid shall conform to the chemical and physical characteristics of table I when tested as specified therein.

TABLE I. Chemical and physical characteristics

Characteristic	Percent by weight				Test paragraph
	Type I		Type II		
	Class 1	Class 2	Class 1	Class 2	
Sulfuric acid, percent by weight, minimum	93.0	93.0	77.5	77.5	4.2.4.2
Specific gravity at 60°/60°F, minimum	1.8347	1.8347	1.7040	1.7040	4.2.4.3
Nonvolatile matter, percent by weight, maximum	0.025	0.025	0.05	0.05	4.2.4.4
Arsenic, parts per million (ppm), maximum	0.02	----	0.02	----	4.2.4.4

**3.3 Material Safety Data Sheets.** Material Safety Data Sheets for sulfuric acid shall be prepared and submitted by the contractor in accordance with FED-STD-313 (see 6.3).

### 4. QUALITY ASSURANCE PROVISIONS

**4.1 Responsibility for inspection.** Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

**4.1.1 Responsibility for compliance.** All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contract

overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

**4.1.2 Contractor assurance of compliance.** The contractor's quality program or detailed inspection system shall provide assurance of compliance of all characteristics with the applicable drawing, special packaging instruction, and specification requirements using, as a minimum, the conformance criteria specified herein.

**4.1.3 Alternative inspection provisions.** Alternative inspection procedures, methods, or equipment, such as statistical process control, tool control, and other types of sampling procedures may be used by the contractor when they provide, as a minimum, the level of quality assurance required by the inspection provisions specified herein. Prior to applying such alternative procedures, methods, or equipment, the contractor shall describe them in a written proposal submitted to the Government for evaluation and approval. (See 6.6.) When required, the contractor shall demonstrate that the effectiveness of each proposed alternative is equal to or better than the quality assurance provisions specified herein. In cases of dispute as to whether the contractor's proposed alternative provides equal quality assurance, the provisions of this specification shall apply. All approved alternative inspection provisions shall be specifically incorporated into the contractor's quality program or detailed inspection system, as applicable.

## **4.2 Quality conformance inspection.**

**4.2.1 Lotting.** A lot shall consist of the sulfuric acid of one type and class produced by one manufacturer, at one plant, from the same materials, and under essentially the same manufacturing conditions provided the operation is continuous. In the event the process is a batch operation, each batch shall constitute a lot (see 6.4).

### **4.2.2 Sampling.**

**4.2.2.1 For examination of packaging.** Sampling shall be conducted in accordance with table II. The sample unit shall be one filled unit or shipping container, as applicable, ready for shipment.

**4.2.2.2 For sulfuric acid test.** See 6.5 for sampling and testing precautions. Sampling shall be conducted in accordance with table III. A representative specimen of approximately 450 milliliters shall be removed from each sample container and placed in a suitable clean, dry container labeled to identify the lot and container from which it was taken.

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TABLE II. Sampling for container examination and tests

Number of containers in batch or lot	Number of sample containers
2 to 15	2
16 to 50	3
51 to 150	5
151 to 500	8
501 to 3,200	13
3,201 to 35,000	20
35,001 to 500,000	32
Over 500,000	50

TABLE III. Sampling for sulfuric acid tests

Number of containers in batch or lot	Number of sample containers
2 to 25	2
26 to 150	3
151 to 1,200	5
1,201 to 7,000	8
7,001 to 20,000	10
Over 20,000	20

**4.2.2.3 For container leakage test.** Sampling shall be conducted in accordance with table II. The sample unit shall be one 1-pint or 5-pint bottle, as applicable.

#### 4.2.3 Inspection procedure.

**4.2.3.1 For examination of packaging.** Sample unit and shipping containers shall be examined for the characteristics listed below. Failure of any sample container to conform to all characteristics shall be cause for rejection of the lot represented.

- (a) Contents per container
- (b) Container
- (c) Container closure
- (d) Vermiculite evident and correct
- (e) Container free of damage and leaks

- (f) Marking evident, correct, and legible
- (g) Palletization (when required)

**4.2.3.2 For sulfuric acid test.** Each sample specimen taken in 4.2.2.2 shall be tested as specified in 4.2.4. Failure of any test by any specimen shall be cause for rejection of the lot represented.

**4.2.3.3 For container leakage test.** Each sample container taken in 4.2.2.3 shall be tested as specified in 4.2.5. Failure of any test by any container shall be cause for rejection of the lot represented.

**4.2.4 Sulfuric acid tests.** See 6.5 for sampling and testing precautions. Tests shall be conducted as follows:

**4.2.4.1 Appearance.** Visually examine the specimen for form and clarity.

**4.2.4.2 Sulfuric acid.** Determine sulfuric acid in accordance with the total acidity method of ASTM E 223.

**4.2.4.3 Specific gravity.** Determine the specific gravity of the specimen in accordance with the Baumé gravity method of ASTM E 223.

**4.2.4.4 Nonvolatile matter and arsenic.** Determine the nonvolatile matter and arsenic content of the specimen in accordance with ASTM E223.

**4.2.5 Container leakage test.** Place the container in each of the following positions, and leave it in each for a period of 15 minutes.

- (a) Upright
- (b) Upside down
- (c) On one side (or one quadrant)
- (d) On one end (or second quadrant)
- (e) On other side (or fourth quadrant)

Examine the container after each period for any evidence of leakage.

## 5. PACKAGING

Note: The metric equivalents given for inch-pound quantities are nominal values provided for informational purposes and should not be considered as quantity requirements.

**5.1 Packaging.** Packaging shall be in accordance with the applicable requirements of 49 CFR 171 to 199 and the International Civil Aviation Organization – Technical Instructions for Safe Transport of Dangerous Goods by Air (ICAO-TDGA) or the International

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Maritime Organization – International Maritime Dangerous Goods Code (IMO-IMDGC), as applicable to the mode of transportation. The packaging shall meet the applicable packaging performance tests specified in ICAO-TDGA or IMO-IMDGC, as applicable.

## 5.2 Unit packing.

**5.2.1 One-pint (0.5-liter) quantity.** A quantity of 16 (+1/8 or -0) fluid ounces (0.5 liter) of sulfuric acid shall be unit packed in a nominal 1-pint (0.5-liter) screw-cap glass or polyethylene plastic bottle conforming to an IP.1 or IP.2 container of ICAO-TDGA or IMO-IMDGC, as applicable. The IP.1 container shall conform to group A, class 1, type d, grade optional with closure A or R, and outer seal A of PPP-C-186. The material used for the bottle shall conform to type I, class M or H, grade 1 or 2 of L-P-390. The thickness of the bottle shall be not less than 0.030 inch. The bottle shall be designed with a finish adapted to a screw cap conforming to closure A or R of PPP-C-186. The closure of the bottle shall conform to closure A with a separate liner or closure R of PPP-C-186. The tightened screw cap shall be secured to the neck of the bottle by a strip of tape applied circumferentially around, and centered over, the juncture between the skirt of the cap and shoulder of the bottle neck. The tape shall have a nominal width of 2 inches and a length of not less than one and one-third times the circumference of the screw-cap closure. The tape shall conform to type 1, class optional of PPP-T-66. There shall be no evidence of container leakage when the bottle is tested as specified in 4.2.5. Each bottle shall be placed upright and centered in a can with vermiculite cushioning. The can shall conform to type V, class 2, type VI tin or terneplate of PPP-C-96. The can shall be coated in accordance with plan B, with side seams striped of PPP-C-96. Sufficient vermiculite conforming to type I, grade 3 of ASTM C 516 shall be used in each can to assure absorption of the entire contents of the bottle in the event of leakage or breakage. The seams of the slip-cover can shall be sealed with the same kind of tape used for the bottle. The IP.2 container shall be the same as specified above except that the bottle shall conform to group A, class 2, style 1, grade 2, closure A, seal A of PPP-C-186.

**5.2.2 Five-pint (2.5-liter) quantity.** A quantity of 5 pints (+5/8 or -0 ounce) (2.5 liters) of sulfuric acid shall be unit packed as specified in 5.2.1 except the container shall be a nominal 5-pint (2.5-liter) bottle.

**5.3 Packing.** Packing shall be level A or B as specified (see 6.2).

### 5.3.1 Level A.

**5.3.1.1 Five-pint (2.5-liter) quantity.** Four 5-pint (2.5-liter) bottles unit packed as specified in 5.2.2 shall be packed upright in a close-fitting, water-repellent treated wooden or plywood box. The wooden box shall conform to the requirements of a 4C1 container of ICAO-TDGA or IMO-IMDGC, as applicable. The plywood shall conform to the requirements of a 4D container of ICAO-TDGA or IMO-IMDGC, as applicable. In addition the

plywood shall be not less than 3/8 inch thick and the cleats 3/4 inch thick by 1-3/4 inch wide. Each box shall be closed and reinforced as specified in accordance with the general packing requirements of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.3.1.2 Five-gallon (20-liter) quantity.** A quantity of 5 gallons (+5 or -0 ounces) (20 liters) of sulfuric acid shall be packed in a nominal 5-gallon (20-liter) steel drum conforming to the requirements of a 1A1 container of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.3.1.3 Six and one-half-gallon (25-liter) quantity.** A quantity of 6-1/2 gallons (+7 or -0 ounces) (25 liters) of sulfuric acid shall be packed in a nominal 6-1/2-gallon (25-liter) composite container or carboy conforming to the requirements of a 6HA2 or 6HD2 container of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.3.1.4 Thirteen-gallon (50-liter) quantity.** A quantity of 13 gallons (+13 or -0 ounces) (50 liters) of sulfuric acid shall be packed as specified in 5.3.1.3 except the container shall be a nominal 13-gallon (50-liter) composite container.

### **5.3.2 Level B.**

**5.3.2.1 One-pint (0.5-liter) quantity.** Twelve 1-pint (0.5-liter) bottles of sulfuric acid unit packed as specified in 5.2.1 shall be packed upright in a close-fitting, weather-resistant fiberboard box conforming to the requirements of a 4G container of ICAO-TDGA or IMO-IMDGC, as applicable. Each box shall be closed and reinforced as specified in accordance with the general packing requirements of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.3.2.2 Five-pint (2.5-liter) quantity.** Four 5-pint (2.5-liter) bottles unit packed as specified in 5.2.2 shall be packed upright in a close-fitting, weather-resistant fiberboard box conforming to the requirements of a 4G container of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.3.2.3 Five-gallon (20-liter) quantity.** A quantity of 5 gallons (+5 or -0 ounces) (20 liters) of sulfuric acid shall be packed in a nominal 5-gallon (20-liter) polyethylene plastic drum conforming to the requirements of a 1H1 container of ICAO-TDGA or IMO-IMDGC, as applicable. In addition, the drum shall have a handle to provide safe handling.

**5.3.2.4 Six and one-half-gallon (25-liter) quantity.** A quantity of 6-1/2 gallons (+7 or -0 ounces) (25 liters) of sulfuric acid shall be packed as specified in 5.3.2.3 except that the container shall be a nominal 6-1/2-gallon (25-liter) polyethylene plastic container.

**5.3.2.5 Thirteen-gallon (50-liter) quantity.** A quantity of 13 gallons (+13 or -0 ounces) (50 liters) of sulfuric acid shall be packed as specified in 5.3.2.3 except that the container shall be a nominal 13-gallon (50-liter) polyethylene plastic container.

### **5.4 Overpacking, 1-pint (0.5-liter) quantity.**

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**5.4.1 Level A.** Two packs of 1-pint (0.5-liter) bottles shall be overpacked in a close-fitting, water-repellent treated wooden or plywood box. The wooden box shall conform to the requirements of a 4C1 container of ICAO-TDGA or IMO-IMDGC, as applicable. The plywood box shall conform to the requirements of a 4D container of ICAO-TDGA or IMO-IMDGC, as applicable. In addition the plywood shall be not less than 3/8 inch thick and the cleats 3/4 inch thick by 1-3/4 inches wide. Each box shall be closed and reinforced as specified in accordance with the general packing requirements of ICAO-TDGA or IMO-IMDGC, as applicable.

**5.4.2 Level B.** Two packs of 1-pint (0.5-liter) bottles shall be overpacked in a close-fitting fiberboard box conforming to the requirements of a 4G container of ICAO-TDGA or IMO-IMDGC, as applicable.

## **5.5 Marking.**

**5.5.1 Container compliance markings.** Each shipping container shall be marked in accordance with ICAO-TDGA or IMO-IMDGC, as applicable.

**5.5.2 Civil agencies.** In addition to the marking required by 5.5.1, shipments shall be marked in accordance with Fed. Std. No. 123 and shall show the date of manufacture and lot or batch number of the sulfuric acid.

**5.5.3 Military activities.** In addition to the marking required by 5.5.1, level A and B shipments shall be marked in accordance with MIL-STD-129 and shall show the date of manufacture and lot or batch number of the sulfuric acid.

**5.5.4 Hazard class label.** Each shipping container and pallet load shall be labeled in accordance with 49 CFR 171 to 199 and either ICAO-TDGA or IMO-IMDGC, as applicable.

**5.5.5 Proper shipping name.** Each shipping container and pallet load shall be marked with the proper shipping name in accordance with 49 CFR 171 to 199 and either ICAO-TDGA or IMO-IMDGC, as applicable.

**5.5.6 Precautionary marking.** Each unit and shipping container shall be marked or labeled, as applicable, in accordance with the 29 CFR 1910.1200(f) to show the required precautionary information. Each outer container shall be marked to show the top of the container by use of an arrow and the word "UP".

**5.5.7 Overpack marking.** Each overpack shall be marked "Inner packages comply with prescribed specification \_\_\_\_\_." (Enter either 4C1, 4D, or 4G, as applicable.)

**5.6 Palletization.** All shipments of containers of 5 gallons or less shall conform to load type VI in accordance with MIL-STD-147 and the pallet shall conform to type IV or V of

NN-P-71. When specified (see 6.2), all other shipments of sulfuric acid shall be palletized in accordance with the applicable requirements of MIL-STD-147.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

**6.1 Intended use.** Sulfuric acid is intended for use in galvanizing and plating ferrous metals and for general purposes. Type I, class 2 sulfuric acid is generally used in soda-acid fire extinguishers.

**6.2 Acquisition requirements.** Acquisition documents must specify the following:

- (a) Title, number, and date of this specification
- (b) Type and class of sulfuric acid required (see 1.2)
- (c) Unit quantity required
- (d) Level of packing required (see 5.3)
- (e) If palletization is required for shipments of containers over 5 gallons (see 5.6)

**6.3 Material Safety Data Sheets.** Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent mailing addresses for submission of data are listed in FED-STD-313.

**6.4 Batch.** A batch is defined as that quantity of material which has been manufactured by some unit chemical process or subjected to some physical mixing operation intended to make the final product substantially uniform.

**6.5 Sampling and testing precautions.** This specification requires inspection of chemical material which is potentially hazardous to personnel. This specification does not purport to address all of the safety problems associated with its use. Sulfuric acid is very corrosive and dangerous when improperly handled. Contact with body results in rapid destruction of tissues and severe burns. Adequate protection against any contact should be provided for all parts of the body. Although the acid itself is not flammable, it may cause ignition by contact with combustible materials; a highly flammable gas (hydrogen) is generated by the action of the acid on most metals. Concentrated sulfuric acid (type I) should not be stored in lead containers. Air pressure should never be used to empty carboys. It is the responsibility of the user of this specification to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

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**6.6 Submission of alternative inspection provisions.** Proposed alternative inspection provisions should be submitted by the contractor to the procuring contracting officer for evaluation and approval by the technical activity responsible for preparation of this specification.

**6.7 Significant places.** For the purpose of determining conformance with this specification, an observed or calculated value should be rounded off "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value in accordance with the rounding-off method of ASTM E 29.

**6.8 Subject term (key word) listing.**

Arsenic  
Material Safety Data Sheet  
Nonvolatile matter  
Specific gravity

**MILITARY INTERESTS:**

**Custodians:**

Army - EA  
Air Force - 68

**Review activities:**

Army - MD, MI  
DLA - GS

**Preparing activity:**

Army - EA

Project No. 6810-1225

**CIVIL AGENCY COORDINATING ACTIVITIES:**

GSA - FSS (9FTE-10)  
LAB - TEC

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of this form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

**I RECOMMEND A CHANGE:**

1. DOCUMENT NUMBER  
0-S-809E

2. DOCUMENT DATE (YYMMDD)  
901116

3. DOCUMENT TITLE

SULFURIC ACID, TECHNICAL

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

7. DATE SUBMITTED  
(YYMMDD)

(1) Commercial  
(2) AUTOVON  
(If Applicable)

8. PREPARING ACTIVITY

NAME

J.S. Army Chemical Research, Development  
and Engineering Center

b. TELEPHONE (Include Area Code)

(1) Commercial  
(301) 671-3259

(2) AUTOVON  
DSN 584-3259

c. ADDRESS (Include Zip Code)

Commander  
U.S. Army CRDEC  
ATTN: SMCCR-PET-S  
Aberdeen Proving Ground, MD 21010-5423

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:  
Defense Quality and Standardization Office  
5203 Leesburg Pike, Suite 1403, Falls Church VA 22041-3466  
Telephone (703) 756-2340 AUTOVON 289-2340