AMMUNITION LOGISTICS

PROPELLANT MANAGEMENT GUIDE

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PREFACE

Joint Ordnance Commanders Group
Quality Assurance Sub-Group
Joint Propellant Safety Surveillance Board

PREFACE TO THE SIXTH EDITION PROPELLANT MANAGEMENT GUIDE MARCH 2014

1. This Joint Munitions Command publication presents methods and procedures to assist users in the safe management of propellant and propelling charge assets.

2. The information in the Guide is derived from a variety of authoritative sources, to include:

- Army Supply Bulletins and Technical Manuals

- The U.S. Army Joint Munitions Command
  Ammunition Surveillance Division

- The U.S. Army Propellant Surveillance Laboratory

- The Naval Surface Warfare Center, Indian Head Division
  Navy Gun Propellant Safety Program

- The U. S. Marine Corps Gun Propellants Program at the Naval Surface Warfare Center Crane Division, Fallbrook Detachment

- Members of the Propellant Safety Surveillance Board

3. This guide is written for Army users with local installation level QASAS and propellant program managers in mind. It may serve as a valuable resource for Ammunition Managers, and for those from all the services who have a level of responsibility in the propellant life cycle.

4. We encourage your comments and suggestions regarding this publication. They may be mailed to United States Army Joint Munitions Command, 1 Rock Island Arsenal, Bldg 350, ATTN: JMC Propellant Stability Program Manager, AMSJM-QAS, Rock Island, IL 61299-6000
, or provided via Email to: *usarmy.RIA.jmc.mbx.amsjm-qas*

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CHAPTER 1 INTRODUCTION

1-1. Purpose

This guide provides information and methods for the safe and efficient storage *and management of propellants and propelling charges. It supplements* information contained in SB 742-1, TM 9-1300-214, SW020-AE-SAF-010 and other sources.

1-2. Scope

The Army publication SB 742-1, Ammunition Surveillance Procedures, states that the Propellant Management Guide "should be utilized" at all installations to aid in the management of propellant stocks. U.S. Army installations that have a receipt, issue and storage mission for Class V materiel should use this publication. It may be used at installations other than Army for information purposes. Large Rocket and Guided Missile Propellants are not addressed.

1-3. Endorsement for use

The Joint Propellant Safety Surveillance Board (PSSB) endorses and recommends this publication for use. The PSSB is a component of the Joint Ordnance Commanders Group responsible for the development of joint propellant safety surveillance policy.

1-4. Background

a. Propellants and propelling charges that we store, transport and maintain warrant our special attention. Among commonly stored energetic materials, only nitrate ester-based propellants (principally nitrocellulose-based have the propensity to spontaneously combust (self-ignite, auto-ignite) without warning while sitting in storage; catastrophic losses can result. Artillery and Small Arms propellants are perhaps the most dangerous materials that Army installations routinely handle and store. Propellant can be unpredictable, decomposing into an unstable condition within four or five years of manufacture. Inadequate propellant safety programs have contributed to several self-ignition incidents at military and commercial installations in the United States and abroad.

b. When grains, flakes, sticks or sheets of propellant inside a container ignite, sufficient heat and flame is produced to ignite the remaining propellant material in that container. If unstable propellant is present in even minimal quantities (e.g., a single container), it might combust and could lead to ignition of the entire contents of the storage structure. Propellant burns at a very rapid rate in a process that is known as ***deflagration***. Deflagration differs significantly from ***detonation*** in that deflagration involves very rapid combustion that takes place on the surface of the propellant. Detonation, on the other hand, occurs due to a different process that involves a shock wave moving at supersonic speeds through the explosive material, thereby causing its

nearly immediate decomposition. Simply put, ***deflagration*** operates on the basis of heat transfer, while ***detonation*** operates on the basis of a shock wave.

c. During the period 1984 through 1997, seven propellant auto-ignition events occurred at U.S. Army Materiel Command (AMC) installations.

1. **1984: Lake City AAP**

IMR powder that was only 5 years old auto-ignited and the above ground magazine & its contents were destroyed. More than 100,000 lbs of powder deflagrated.

2. **1984: Lake City AAP**

The same lot of IMR powder, a fragment quantity isolated and saved for critical production testing, auto-ignited two months after the previous fire. Only a small quantity of powder was lost, but another magazine was destroyed.

3. **1985: Blue Grass Army Depot**

The local-stocks storage magazine used for demilitarization activities contained high explosives material as well as unmonitored **M10 propellant** powder. Auto-ignition of the powder and its resulting deflagration gradually ignited the other energetic materials present. The earth covered magazine and its contents were destroyed.

4. **1987: Lone Star AAP**

Benite was stored in a heated magazine so that it could be temperature conditioned prior to loading into production items. The building became overheated which accelerated the rate of decomposition of the benite to a point that auto-ignition occurred. The structure and contents were lost.

5. **1989: Hawthorne Army Depot**

8-inch, 55-caliber **propelling charges** loaded with **single-base propellant** auto-ignited in an earth-covered magazine more than one year after the Navy ordered the lot destroyed due to low stability. The magazine contents of 30,715 lbs of various propellants were destroyed, and the magazine was heavily damaged.

6. **1996: Red River Army Depot**

Expulsion charge assemblies for large caliber artillery rounds, each charge filled with only **one ounce** of **M10** propellant and stored 250 to a box,

auto-ignited. The earth-covered magazine and its contents were totally destroyed.

7. **1997: Hawthorne Army Depot**

M9 flake propellant bags that had been removed from 81MM mortar rounds were bulk-packed and placed into long-term storage. A container of unstable propellant auto-ignited and all 20,000 lbs of propellant inside the earth-covered magazine were destroyed. The magazine was severely damaged. Value of contents lost was more than $3,000,000, while the cost to repair the magazine was $164,000.

d. Accidental auto-ignition of propellant occurs at other than Army facilities, too. During the same time period as the incidents above, propellant self-ignition accidents have occurred at Navy facilities, at privately owned industrial storage sites and ammunition storage areas of other nations. If you consider the number of accidents versus the limited number of locations that store artillery and small arms propellants, you realize that the chances of having an accident happening at *your* installation are not as unlikely as you may have imagined.

CHAPTER 2 PROPELLANT STABILITY PROGRAM

NOTE: *Most of the instructional provisions of Chapter 2 do not apply to Navy-owned/developed gun propellants. Special provisions for Navy propellant are found in Chapter 3.*

2-1. Defining the Propellant Stability Program

The Propellant Stability Program (PSP) is a sub-program of the Stockpile Laboratory Test Program (SLTP). The SLTP is one of the three major elements of the Department of the Army's Ammunition Stockpile Reliability Program.

The purpose of the PSP is to provide surveillance of propellant stability through:

a. Continuous laboratory surveillance

b. Periodic chemical analysis of stabilizer content

2-2. Definition: Stabilizers

STABILIZERS are chemical ingredients added to propellant at time of manufacture to decrease the rate of propellant degradation and reduce the probability of auto-ignition during its expected useful life.

As nitrocellulose-based propellants decompose, they release nitrogen oxides. If the nitrogen oxides are left free to react in the propellant, they can react with the nitrate ester, causing further decomposition and additional release of nitrogen oxides. The reaction between the nitrate ester and the nitrogen oxides is exothermic (i.e., the reaction produces heat). Heat increases the rate of propellant decomposition. More importantly, the exothermic nature of the reaction creates a problem if sufficient heat is generated to initiate combustion. Chemical additives, referred to as *stabilizers*, are added to propellant formulations to react with free nitrogen oxides to prevent their attack on the nitrate esters in the propellant. The stabilizers are scavengers that act rather like sponges, and once they become "saturated" they are no longer able to remove nitrogen oxides from the propellant. Self-heating of the propellant can occur unabated at the "saturation" point without the ameliorating effect of the stabilizer. Once begun, the self-heating *may* become sufficient to cause the spontaneous combustion we usually refer to as *auto-ignition.*

2-3. Propellant Stability Categories

a. **Remaining Effective Stabilizer (RES)** is the term we use to describe the measure of virgin stabilizers plus active daughter products that are present in the propellant at the time of stability test; the term Effective Stabilizer (ES) is sometimes used and is equivalent to RES. The RES that has been determined to remain in a lot of propellant is expressed in *percentage* of *total mass*. For example, if a lot of propellant

has an RES of "1.00% DPA," it means that the stabilizing ingredient diphenylamine (and its active daughter products) makes up 1.00% of the propellants mass, while other ingredients (nitrocellulose, dibutylphthalate, etc.) make up the remaining 99.00%. Because we generate a mass quantity of varied percentages to express RES, we have found it convenient to establish *fixed ranges* of stabilizer levels. We call these ranges ***Stability Categories*** (SC) and assign one of three alpha characters (A, C, & D) as the ***Stability Category Code*** for each range.

b. Knowing the SC of any lot of propellant allows you to more easily manage the safety of propellant stocks. Even though there are many different formulations and physical configurations of propellants in the PSP, we have devised these three simple, uniform SC that apply equally to all propellant types *except* the Navy-developed SPCF/NACO/BS-NACO type. A single system works because the top range of RES represented uses no upper limit, only a lower limit. Therefore, *excepting* SPCF/NACO/BS-NACO, *all* propellants of *any* type that have *any* level of RES that is 0.30% or more should be considered safe for continued storage until the next scheduled retest interval. Detailed explanations of each SC Code are found in Chapter 13, SB 742-1.

c. **Why is there no SC-B?** When SCs were created, four stability ranges were established: SC Codes A, B, C and D. After many years of using four codes, we realized that there was no practical difference between codes A and B. Although SC-B indicated a reduced level of RES, SC-B propellants were considered safe and stable (within the propellant's inherent limits) for long-term storage and use, as were the propellants in SC-A. Therefore, in 1995 it was decided to eliminate SC-B and retain only three fixed ranges of stability categories: SC-A, C, and D.

d. **Stability Characterization for SPCF/NACO/BS-NACO.** Years of testing by the service laboratories have revealed that the ethyl centralite (EC) stabilizer in the SPCF/NACO-type propellants normally does not significantly deplete over time despite the decomposition of the nitrocellulose. These propellants must be tested to demonstrate a fume time of greater than 30 days as determined by the accelerated age test of MIL-STD-286C Method 407.1, 65.5^{0}C Surveillance Test. Therefore, the Propellant Stability Program will continue to identify these propellants on the stability database by RES and Stability Category A, C or D. The SC assigned will be based upon consideration of the RES *and* the number of days to fume.

NOTE: SPCF/NACO-type propellants are loaded into DODICs D264, D305, D324, D326, D610 and D611 (5/38, 5/54 and 8/55 Propelling Charges).

Table 2-1 Stability Category Codes

STABILITY CATEGORY	PERCENT EFFECTIVE STABILIZER
A	**0.30** or MORE
C	**0.29 - 0.20**
D	LESS THAN **0.20**

A – *Acceptable stabilizer loss.* Lot is safe for storage until required retest date.

C – *Significant stabilizer loss.* Lot does not represent an immediate hazard, but may be approaching a potentially hazardous stability condition. This level of stabilizer loss does not adversely affect functioning in a finished round configuration.

D – *Unacceptable stabilizer loss.* Lot presents a potential safety hazard and is an unacceptable risk for continued storage as bulk propellant, bulk-packed components, or as separate loading propelling charges. The risk of auto-ignition of propellant in SC-D increases with time. Demilitarization must be completed within **60 days** of notification for bulk propellant, bulk-packed components, and separate loading propelling charges.

2-4. Component Programs of the PSP

Propellants that are known to be stored anywhere by the Army are monitored and tested for stability. Installations are provided with the information necessary to make sound storage decisions. The PSP produces this information through its two component programs, the *Master Propellant Program* and the *Stockpile Propellant Program*.

Sub-Chapter 2a: MASTER PROPELLANT PROGRAM (MPP)

2a-1. What is the MPP?

The Master Propellant Program (often called the Master "Sample" Program) has operated continuously at Picatinny Arsenal, New Jersey since 1921. The Master Samples are "control" samples that are stored under known conditions. These samples are used to monitor the long-term stability of each lot of Army propellant that qualifies for inclusion in the MPP. A Master Sample remains under surveillance until the parent quantity of that lot is no longer in the stockpile.

a. The MPP requires little or no supporting action from the storing installations. The original sample supplied to the lab by the manufacturer is usually a sufficient test quantity to cover the entire stockpile life of the propellant. To require a storing installation to replenish an exhausted master sample is rare.

b. Unless the specification allows for a reduced quantity, producers of Army propellant are required to submit a 5-pound master sample within 6 months of manufacture to the Armament Research, Development and Engineering Center's (ARDEC) Army Propellant Surveillance Laboratory (APSL) located at Picatinny Arsenal. Until the mid-1990's, a tiny portion from each of the newly received samples would be placed under continuous monitoring inside one of eight large (walk-in), circular ovens as part of the Method 407.1, found in MIL-STD-286C. The Method 407.1 is also known as the "fume" test. Because the fume test is not predictive and many types of propellant do not react to the test, a new semi-predictive or pseudo-kinetic test called the Safe Interval Prediction (SIP) test largely replaced the fume test at ARDEC during the mid-

1990's. Today the fume test is used only under specific circumstances described in 2a-2b below.

2a-2. 65.5^{0}c Accelerated Aging Test (AAT)

a. **The Past:**

(1) Using test protocols that were developed in the early years of the 20th century, a U.S. Navy AAT facility was established in 1921 at the Naval Powder Factory in Indian Head, Maryland. A sister program for the Army followed later that same year at Picatinny Arsenal, New Jersey, a site of Army propellant production.

(2) The AAT involved placing small propellant samples in stoppered glass bottles that lined the wall and center storage racks of each heat chamber. The sample bottles were checked each duty day for the presence of reddish-brown fumes, fumes that would tell the checker that the end of the propellant's stable life was near and might be approaching a state of auto-ignition. At this point, the number of days the sample had been in the chamber was noted in the records, the sample bottle was removed from the chamber, and the contents were emptied and discarded. A replacement master sample quantity from their storage magazine was put into the bottle and placed back on a shelf in the heat chamber. Each test cycle lasted from a few dozen to several hundred days. This process was repeated again and again for scores of years on every one of the many thousands of individual propellant lots.

(3) It was expected that the AAT could be used to predict a propellant's safe storage life by simply "plugging in" the proper ratio of days-to-fume in the heat chamber to the actual number of days storage required in a non-artificial environment. Various attempts over the years to impart a predictive value for the AAT have met with frustration. In practice, the AAT has not been successfully used in a truly predictive manner, though the Navy has found a level of predictive capability when applying fume time to the old 16" SPD gun propellant that is more useful than RES levels alone. In any case, the AAT does provide a valid pass/fail stability determination, though the test result should be considered little more than a "snapshot" of a single propellant lot's thermal stability at a particular point in time.

b. **The Present:**

(1) The AAT is still used to establish a "base line" for newly received propellants. All new master samples are accelerated aged for 365 days to observe fume behavior (except for triple-base propellants, which do not exhibit fumes). This test assures that newly manufactured propellant has no incompatibility or in-homogeneity present that would affect long term stability.

(2) All propellants that are nearing the end of their safe life undergo the AAT for 45 days to observe for possible 30-day fume failures. This procedure allows full compliance with existent Tri-Service criteria.

(3) If the fume time is short (30 days or less) or an unusual result is indicated on an individually tested sample, the propellant lab conducts an analysis of the propellant to determine the percentage of remaining effective stabilizer (RES) to better determine the safety status of the propellant.

(4) If this test, in conjunction with the 65.5^0C results, confirms the impending instability of the propellant, the propellant program manager in the Surveillance Division at the Joint Munitions Command (JMC) is immediately notified.

c. **Fume Testing SPCF/NACO/BS-NACO Propellants.** The stability of Navy-developed propellants identified as SPCF, NACO and BS-NACO continue to rely upon the fume test as the best means to determine real-time thermal stability. The ethyl centralite (EC) stabilizer in the SPCF/NACO-type propellants does not significantly deplete over time despite the decomposition of the nitrocellulose. It is believed that these propellants can become thermally unstable while retaining an RES level that would place the propellant in SC-A or SC-C.

2a-3. Safe Interval Prediction Test (SIP)

a. The SIP test uses zero order reaction kinetics to assess the safe storage condition on all of the Army's 30-plus types of propellant in its inventory. The test generates its own safe storage and retest interval on a lot-to-lot basis.

b. The test measures the decrease of virgin stabilizer using High Performance Liquid Chromatography (HPLC) test equipment. The test is run at 65.5^0C as in the AAT to simulate aging of the propellant. Each sample is initially tested prior to aging and the level of remaining effective stabilizer (RES) is determined.

(1) The SIP test is designed to provide the retest intervals normally provided by the certain, yet sometimes unpredictable fume event. The kinetic calculations estimate the time required to deplete the effective stabilizer to zero concentration. Fume times for a single propellant lot can vary greatly from one cycle to another; the intervals can decrease over time and then increase before failure occurs. Due to factors that include the shorter periods of time that the propellant is subjected to high temperatures, and the better moisture control of the SIP aging ovens, the SIP test is better able to provide *predictable* propellant behavior in a way that chemically relates to what we understand to be the onset of instability.

(2) Using this SIP information plus the known average life of propellants under the normal range of storage conditions, a reasonable factor is used that provides for multiple retests over the life of the propellant. For example, a single base propellant generally has a life of 50 to 75 years. The safe interval predicted by the SIP method is not allowed to exceed 15 years. The method then establishes six to eight intervals or more over the life of a typical single-base propellant. Increasingly frequent intervals are

usually required as the propellant ages because the predicted safe interval becomes smaller.

c. No attempt to predict the entire shelf life of a propellant is made. The retest interval represents a period of time during which the rate of reaction is such that the effective stabilizer cannot be brought to a dangerously low level. Sufficient stabilizer to prevent auto-ignition will be present at the end of the test interval.

d. As previously mentioned, the safe storage and retest interval decreases over the life of the propellant, so the test frequency increases as the propellant approaches instability. All Stability Category "C" propellants are tested each year for RES level and 30-day fume failure; the SIP test is discontinued.

2a-4. When Master Sample Stability Failure Occurs

a**. Stability failure** of a Master Sample is a trigger that causes the APSL to immediately notify the JMC Surveillance Division. Normally, the **JMC will take one of two actions:**

(1) JMC will **permanently suspend** the propellant lot and transmit a Notice of Ammunition Reclassification (NAR) message. The NAR will require *immediate* (within 60 days) demilitarization of the lot if it is packaged as bulk propellant, bulk component charges, or as separate loading propelling charges. The demilitarization process will remove the military characteristics from the propellant. The method of demilitarization will involve either a Resource Recovery and Recycling (R3) action or treatment (see Chapter 6 for details), usually by burning.

Or

(2) JMC will review the storage records and determine the impact upon stockpile levels if the lot is eliminated. If there is reason to believe that the Master Sample test results may not accurately reflect the stability level of actual stockpile assets, a sample (or samples) may be selected from a storing installation for special test. Any action concerning final treatment/disposition of the lot will be held in abeyance pending stockpile test results.

b. Master Sample test failure usually results in the **immediate demilitarization** of the lot in storage. The second action above is rarely taken.

c. Installation management actions for suspended propellants are detailed in Chapter 5.

2a-5. Storing Installation Surveillance Responsibilities

a. At the installation level, the surveillance action necessary to support the MPP is minimal. Such action usually involves the infrequent preparation of a quantity (three

to five pounds) of propellant for shipment to the APSL to replenish a depleted or missing Master Sample. If you are requested to prepare and send a replacement Master Sample, assure the Depot Surveillance Record (DSR) card is annotated to the effect that:

(1) The sample was selected and shipped for the Master Propellant Program.

(2) Further action on the propellant lot is not pending; sample selection and shipment for the MPP is simply the filling of a customer's order. You will *NOT* receive test results or other feedback.

b. Take note that the condition code of the lot from which the Master Sample was selected will *NOT* change due to the sampling. Do *NOT* apply "CC-D pending test results" unless specifically directed to do so by JMC.

Sub-Chapter 2b: STOCKPILE PROPELLANT PROGRAM (SPP)

2b-1. What Is the SPP?

a. The SPP is the part of the PSP that is responsible for the selection and testing of propellant samples from lots in worldwide storage locations; it is the stability program with which the storing installations have regular contact. Samples are requested annually by the JMC Surveillance Division and are prepared and sent to the APSL for analysis of safe storage life. Future retest intervals will be determined that will range from one to fifteen years, depending upon the predicted aging behavior of the lot.

b. RES levels are determined for the SPP samples by the APSL chemists using High Performance Liquid Chromatography (HPLC) test equipment. Concurrently, a Master Sample of each SPP lot tested is brought into the lab and tested, serving as both a control and a comparison. By comparing the results for the Picatinny Arsenal-stored Master Sample and the SPP sample that is, perhaps, stored under very different environmental conditions, dissimilar aging behaviors may be detected.

2b-2. ESTABLISHING INITIAL PROPELLANT STABILITY TEST DATE

a. The date for a new propellant's initial stability test depends on type of pack and in some cases, type of propellant.

(1) Lots stored in *metal containers* (cans or drums) or in *metal-lined wood containers* (Level A pack) are not due an initial stability test until **FIVE YEARS** from date of manufacturer of the propellant lot, with the exception of M5, M10 and M26 propellant, which will be due in two years regardless of pack.

(2) Lots stored in *fiber drums* (Level C pack), regardless of propellant type, are due for their first stability test in **TWO YEARS** from date of manufacturer of the propellant lot.

b. An example is as follows:

(1) C436 GDL07J003-001 is loaded with propellant lots RAD06F-G69363 & RAD05J-071926.

(2) Even though the C436 lot was manufactured in 2007, we have to go by the component propellant lot dates of 2006 and 2005, which would mean an initial test date of 2011 and 2010 if packed in a metal drum.

(3) If the C436 is packed in a fiber drum, then the initial test dates would be 2008 and 2007.

2b-3. Establishing Stockpile Test Intervals

a. Three sets of test results are used in the establishment of a retest interval for a propellant lot: the SIP test, the stockpile sample HPLC test and the Master Sample HPLC test conducted at the same time as the stockpile test. The SIP test is afforded greatest consideration in the retest calculation since it is based upon kinetic data and is a good predictor of the future behavior of propellant.

b. The current stockpile test program offers greater confidence in the safety of the stockpile than did the earlier, more frequent test methodologies. Prior to the SIP test, retest intervals for fielded propellants were no greater than five years. Retest intervals are now much less frequent, often as much as fifteen years. Since selecting and preparing propellant samples for shipment is both time-consuming and expensive, the current test methodology represents a great step forward in the surveillance of propellant.

c. Propellant stability information is available on the Munitions History Program (MHP). The MHP website can be accessed at http://mhp.redstone.army.mil. A CAC login is required. Once you have entered the MHP website, select the ASRP tab on the menu bar and select ASRP Firing Data/Query Firing Data/View Reports/Propellant Stability. Next make a selection between a basic report and a custom report.

2b-4. Selection, Preparation and Shipment of Samples

NOTE: *Samples should always be prepared and shipped per the direction of the requesting activity, usually HQ JMC. The information below is an expansion of the directions in Chapter 13 of SB 742-1.*

WARNING! ***Don't Make Waste!*** If you are unable to locally dispose of less-than-full unit of issue propelling charges that result from propellant sampling then you must notify the JMC PSP manager and request permission to ship a full unit of issue! (for example: one complete propelling charge versus 1 lb sample). We don't want to generate propellant residue/incomplete charges at installations that cannot

be disposed of locally. Propellant residue should be demilitarized as it is generated. At licensed and permitted locations the most likely demilitarization method for such residue will be destruction by burning.

a. **Sample Selection.** Most samples will be selected from separate loading propelling charges. Normally, a one pound samples per lot is requested, although samples will also be requested from bulk propellant and bulk-packed component charges. ***Check*** the Ammunition Data Card (ADC) for each *separate loading* or *semi-fixed* propelling charge lot to verify that it is or is not a dual-granulation, dual-lot charge.

(1) **Separate loading propelling charges** may consist of complete rounds that are shipped in their original packaging configuration if the installation the sample is selected from cannot dispose of sample residue locally.

(2) **Bulk-Packed Component bag charges for Semi-fixed Ammunition** (such as the M67 charge for 105MM Howitzer) should be as close to the sample size as requested without opening individual increment bags or disassembling a charge. For example, the seven-increment M67 charge contains two lots of M1 propellant (increments 1 and 2 are a single-perforated grain of a lot distinct from the multi-perforated grains in increments 3 through 7). Unless *specifically* requested to do otherwise, COMPLETE PROPELLING CHARGES will be packaged and shipped. See **WARNING** above before disassembling M67 or other charges.

(3) **Bulk-packed increments and charges for mortars** shall be shipped in the quantity specified by the sample request. Do ***NOT*** remove propellant from the individual bags unless *specifically* asked to do so in your instructions from the requestor.

a) The sample size will be approximately one-half pound of propellant per lot.

b) The requestor (JMC) will make every effort to request samples sizes that are standard units of issue.

(4) **Bulk-packed propellant** (loose grains) sample size will usually be one pound.

b. **Sample Preparation.**

(1) Outer pack for samples will consist of standard ammunition containers meeting the requirements of Title 49, Code of Federal Regulations (CFR), or latest Bureau of Explosives (BOE) Tariff 6000. Approved outer packs for propellant samples include:

- Special Packaging Instruction (SPI) ADP1376-002 (Revision B or later for M2A1 ammunition container) (SPIs can be accessed on the MHP website https://mhp.redstone.army.mil/MhpMain.aspx).

- Metal-lined wood boxes

- Metal drums

- Fiber drums.

All packs must meet both the maximum container load limit for which they were Performance Oriented Packaging (POP) tested, and the applicable packaging drawing marking requirement.

(2) It is likely that only a few individual propellant grains will be used for test purposes out of the entire sample submitted, even though your sample submission may consist of hundreds or thousands of grains! **Good sampling techniques** should be used as follows.

- When removing a one-pound sample of propellant grains from a bulk container or from charge bags, select the sample from a *single location*.

- Identify that location on the sample baggie for lab personnel to see (e.g., "Sample Selected from Top of Drum," "…Center of Drum," "…from Charge 3 where it abuts charge 4," etc.).

- Sometimes, the unused portion of the propellant sample received by the lab is used to supplement the Master Sample when it is expended in testing, thus adding to the importance of good sampling and packaging procedures. If *more than one pound* is selected from a single lot, *each pound* should be selected from a different container or charge.

(3) Place each sample in an anti-static plastic bag of the smallest size needed to hold the sample. Assure all personnel and equipment grounds are in place as may be required. Seal the sample anti-static bag by one of the **three following methods:**

a) Fold the bag opening over three times to close and apply two single wraps of **tape** that overlaps itself a minimum of one inch.

b) Gather the bag opening together and tie with a **twist tie**.

c) Use an anti-static **zip-lock** type bag:

11" x 10" zip-lock: 8105-00-837-7756
12" x 12" zip lock: 8105-00-837-7757

(4) Place the cushioned samples into an M2A1 Small Arms Container, per SPI ADP 1376-002.

(5) **Packaging materials and methods** that meet POP requirements include:

a) **Static dissipative plastic** barrier material, MIL-PRF-81705, NSN 8135-01-185-6816 (available by the roll)

b) **Conductive/velostat** material, MIL-B-82647, NSNs 8105-01-274-3585 & 8105-01-382-7369 (large & small plastic bags)

c) **Barrier materials**, MIL-PRF-131, NSNs 8135-00-282-0565 & 8135-01-015-2810, may be heat-sealed and are good for overpacking the plastic bags.

d) **Metal drums**, **fiber drums**, or **metal-lined wood boxes** per MIL-STD-652 are acceptable if bulk containers are desired.

e) **Telescoping spiral-wound fiber container** having metal ends and double-foil inner wrap may be used for component charges and charge increments (but not if propellant is exposed). Add cushioning material to each end of the container to obtain a tight pack, and close with two wraps of tape.

f) **Plastic bag** or **Plastic wrap** (anti-static plastics) should be used to package large individual grains or stick propellant (such shipments are quite uncommon). Bag and tape-seal each grain or stick, or wrap and tape. Cushion as required with anti-static bubble-wrap or closed-cell foam material.

(6) Expose samples to the air for the minimum time needed to package. Do not desiccate samples. On a card, type or print the following information:

- NSN
- Lot Number
- Name of the Submitting Installation
- Test Number

Tape this card to the propellant sample bag. Include **DSR** card and ADC for each lot.

a) **Dual Granulation Charges** require a slightly different identification procedure than that in 2b-4b (6) above. Pack dual granulation charges into separate bags, but on each identification card type or print the following information:

- NSN of the Charge Lot
- Complete Charge Lot Number
- Lot Number of the Component Propellant Lot in the Sample Bag
- Type of granulation of the lot (multi perforated [MP] or single perforated [SP])
- Name of the Submitting Installation
- Test Number

Tape this card to the propellant sample bag. Include **DSR** card and **ADC** for each lot.

Both component lots of a single propelling charge lot should be placed into the same outer pack.

b) *Do not* print sample information directly to the inner pack, as damage to the pack may occur, to include flaking of aluminized bag material that destroys the written information. Tape ID cards to the propellant sample bag.

c. **Sample Shipment.**

(1) After preparing and packaging the samples actual shipment may be delayed for an indefinite period. These delayed sample shipments can lead to ignored or forgotten propellant samples in storage. For good management of all propellant sample shipments, the **following actions** are recommended.

a) Establish a **local tracking action** on all prepared samples. If Materiel Release Orders are delayed or cancelled your local surveillance organization will be "flagged" to take appropriate closing action on the sample packages involved (i.e., local destruction, request disposition from JMC, etc.)

b) **Insert a remark** into each DSR card that sample has been selected and packaged and is awaiting shipment. When samples are shipped, enter a comment with pertinent shipment information into the DSR.

(2) Unless otherwise directed, samples will be shipped to:

(a) Army.

Commander
U.S. Army Armament, Research, Development
and Engineering Center
Attn: RDAR-MEE-P (Bldg 938)
Picatinny Arsenal, NJ 07806-5000

(b) Navy.

Commanding Officer
Indian Head Division
Naval Surface Warfare Center
Explosives Scales, Attn: 4210F
Indian Head, MD 20640-5035

2b-4. Propellant Residue from Sampling

If you have generated propellant residue from your sample preparation, assure the residue (remains of propelling charge) is properly repackaged and identified on stock records if returned to storage. It is likely that such residue will be considered **Waste Military Munitions (WMM)** per the Munitions Rule. You should plan to dispose of such residue either the same day that it is generated or as soon thereafter as possible, in order to avoid the responsibilities associated with the storage and maintenance of WMM.

2b-5. Marine Corps Propellant Test Program

The U.S. Marine Corps maintains their own propellant stability test program that leverages the Army data and tries to test only propellant stocks that are owned solely by the Marine Corps. If Marine Corps stocks are on hand and there is no stability test data available through the Army PSP, then supporting Quality Assurance Specialist (Ammunition Surveillance) (QASAS) or other surveillance personnel should contact the Marine Corps for propellant stability information prior to reporting the lot to JMC to assure the lot is not managed under the Marine Corps Propellant Test Program. Marine Corps Propellant Test Program contact information is in Appendix G.

CHAPTER 3 NAVY GUN PROPELLANT SAFETY SURVEILLANCE

NOTE: SW020-AE-SAF-010, Technical Manual "Safety Surveillance of Navy Gun Propellant," Policy and Procedures, 31 August 1996, is the best source for detailed information beyond the scope of this chapter.

3-1. Background

a. The history of the Navy propellant surveillance program is very similar to that of the Army. Established at Indian Head, Maryland during the immediate post-World War I period, the Navy program was physically and technically a virtual twin of the Army program. The Navy propellant surveillance program was established in 1920, several months before the Army program began. Among the oldest useful physical remains of the interwar program are the large walk-in propellant heat chambers, built around the same time (1940-1941) as those that were recently retired at Picatinny Arsenal. These heat chambers, or ovens, have circular interiors, and are considerably different from the original 1920 units that were rectangular in shape and heated by steam. Steam had proven to be an insufficiently reliable and precise method of heating.

b. Auto-ignition of propellant in the powder magazines aboard ship has caused the loss of several warships from the navies of various nations, most losses having occurred in the first few decades of the 20th century. The risk of unstable propellant aboard ship was so great that, even after more effective stabilizers were introduced during the second decade of the last century, close monitoring of all the fleet stocks was considered essential. In fact, prior to 1963, each activity and ship had its own testing oven and was required to run a 65.5^{0}C surveillance test for 60 days each year on every lot of propellant in storage or on board. Propellants in many configurations that would be considered safe for use by the Army (such as propellant loaded into fixed rounds) have been and continue to be regularly condemned and destroyed by the Navy. Such ammunition is considered to be too hazardous for shipboard stowage. Even relatively minor propellant deflagrations can cost the lives of sailors and marines under such confined circumstances.

c. Information necessary to assure the safety of Navy propellant stocks (and the vessels upon which they are stowed) is provided to the fleet and the storage installations (Navy coastal and Single Manager for Conventional Ammunition (SMCA) locations) through the monitoring and testing of all Navy propellants. The Navy Gun Propellant Safety Surveillance program produces this information through its two programs, the **Master Sample Program** and the **Fleet Return Program.**

3-2. Master Sample Program

a. For the purposes of this publication, it is sufficient to say that the Master Sample Program is the same as the Army MPP prior to the adoption of the predictive aging test. Test procedures for the 65.5^{0}C test and minimum days to fume time are

virtually identical. The following are the most significant ways in which the Navy Program differs from that of the Army:

(1) The term **"Propellant Index"** is used by the Navy *instead* of **"Propellant Lot."** Do not be confused by the use of "index" when referring to Navy propellant; each index is a unique number that applies to only one lot of propellant. Use it as you would use a lot number.

(2) The Navy maintains Master Sample laboratory surveillance for many propellants that the Army MPP ignores.

(a) They conduct the 65.5^{0}C Accelerated Aging Test (AAT, "fume test) for most Navy propellants (bulk, separated, separate loading, component charge, & fixed round).

(b) Triple-base propellants are tested for Remaining Effective Stabilizer (RES) in lieu of the AAT that is ineffective for such propellants.

(c) Other propellants that are not constantly or routinely included in the AAT are those propellants used for any calibers below 20mm, as well as some 20mm, 25mm, 30mm, and some Navy-owned ammunition that is designed and used by the Army (and included in the Army MPP).

(3) The Navy takes action against major caliber ammunition that is loaded with low stability propellant. If a lot of propellant fails the fume test (fumes in less than 30 days) *and* that lot is loaded into Army-owned rounds up to 127mm, the Army will take no immediate action against these fixed round assets. If the propellant is loaded into the same or similar Navy rounds, the fixed round lots into which that propellant is loaded will either be ordered destroyed by the Navy, or a retest from fleet stocks may be ordered. A retest might be prudent if the assets in question are in demand and/or in short supply. The Army policy is best explained by excerpting the NOTE from SB 742-1, paragraph 13-9a:

"Immediate treatment directives disseminated by the Navy on Navy-specific bulk propellants or bulk-packed component charges will not apply when loaded into weapons systems smaller than 5 inch (127mm) that are currently in an Army ownership account, or after the items have been transferred to an Army demilitarization account. Army experience has demonstrated that uploaded propellants in such rounds have never auto-ignited."

b. The Navy maintains detailed records for each lot or index of their propellant. These records identify the final end item into which the propellant has been loaded (with the inevitable instances of information voids). The Navy is usually able to identify where their unstable propellant is located and into which end item lot it is loaded. Of course, accountability and/or inventory errors do sometimes occur, so even this excellent system cannot be considered 100% reliable.

c. The Navy conducts the Master Sample Program in the same relative anonymity as the Army's MPP. Like the Army, the results and records of the Master Sample Program are not disseminated to individual storage installations or to the fleet, but rather are used by the technical staff at Naval Surface Warfare Center, Indian Head, Maryland (IHDIV).

3-3. Fleet Return Program

a. The Fleet Return Program is similar to the Army's Stockpile Propellant Program in the way that "fielded" stocks are actually tested in addition to the continuous tests of the Master Samples. However, the Navy's Fleet Return Program is not nearly as extensive in operation as is the SPP. Like the SPP, individual samples are tested for RES using High Performance Liquid Chromatographic (HPLC) testing. These methods are comparable to those of the APSL at Picatinny Arsenal.

(1) Indian Head has been conducting an increasing number of the stabilizer tests for this program using a mobile laboratory facility in conjunction with the Mobile Ammunition Evaluation and Reconditioning Unit (MAERU) team. The MAERU operates per OPNAV instruction 8000.16, Chapter II, paragraph 4.3. The mobile lab (a modified 8' x 8' x 20' ISO container) produces valid results quickly on-site, reducing the time from initial sampling to test result from several weeks to just a few days.

(2) The Navy places less reliance on the Fleet Return Program than does the Army upon the SPP. To the Navy, the Fleet Return Program is more an adjunct to the Master Sample Program, which has amassed an impressive record in allowing the Navy to avoid *any* instances of propellant auto-ignition in a ship's magazine.

b. The likelihood of being called upon to prepare samples for the Fleet Return Program at the present time is not great. This program may grow, but the limited scope of the program today makes the likelihood of your interaction small.

3-4. Local Management of Navy Propellants

a. The requirement for installations to maintain known stability information does not apply to Navy-tested propellants. Although the Navy's propellant stability management system is different from that of the Army, it *is* a system that works.

b. Because of its low reliance on testing that provides "percent stabilizer" for individual lots, the Navy does not routinely assign "Stability Categories" to its propellants. Don't be looking for Navy-developed/Navy-owned propellants on the JMC "Propellant Database" website; you'll find them there on an exception basis only.

c. Be assured that the Navy, through its Gun Propellant Safety Surveillance organization at NSWC, Indian Head (IHDIV), continues to apply effective safety

surveillance on its propellant assets. When an index is found to be unstable or nearing the end of its storage life, the Navy's action is very much like that of the Army.

(1) IHDIV provides recommendations for ammunition reclassification to the Program Managers of the various Naval ammunition programs (NAVSEA, NAVAIR & USMC). The appropriate Program Manager then makes a reclassification decision and directs the Naval Ammunition Logistics Center, Inventory Management and Systems Division (NALC/IMSD) Mechanicsburg, PA to issue a Notice of Ammunition Reclassification (NAR) for the affected index and/or complete round lots into which the propellant is loaded. You must treat this sentencing to destroy these stocks as seriously as you would an Army NAR that orders immediate destruction of Army bulk or bag charge propellant.

(2) The NAR information will be included in the next version of NAVSUP P-801/TW024-AA-ORD-010, "Ammunition Unserviceable, Suspended and Limited Use," the Navy's suspension and restriction manual. The propellant suspension information will remain a part of the publication for several years, until the Navy is confident that no traces of the propellant remain.

(3) **NAVSUP P-801** is on the web at https://nossa.nmci.navy.mil/nrws2/Programs/ExplosivesSafety/Library/InstructionsPubsCurrent/tabid/124/Default.aspx. Registration and CAC login is required. Scroll down to find NAVSUP P801 and click on the "(entire version)" link. There is also a link to contact the NAR desk in order to obtain recent NAR and AIN messages that have not been posted to the manual.

(4) **MARINE AMMUNITION KNOWLEDGE ENTERPRISE (MAKE)** can also be used to access the NAVSUP P801 on the web at https://www.make.usmc.mil/kmp/index.aspx Registration and CAC login is required. Click on "P" in the Alphabetical Directory and select "P801".

3-5. Documentation of Stability Levels

Individual storing installations are not required to post, nor do they have access to, stability levels of individual Navy propellant lots. The Navy system tells the storing installations to assume that, unless notice to the contrary is received, the propellant lot or index is stable. Although this is simpler than the Army system, it lacks the Army's installation-level safeguards that may be more likely to assure the identification and demilitarization of unstable propellant. NSWC-Indian Head has considered making available a website similar to the MHP Propellant Database website, but it is not expected to be available for use in the near term.

a. When shipping Navy propellants, it is very important to check the NAVSUP P801 suspense manual, since this will be your only source to guard against shipping unstable propellant (no DSR card annotation).

b. You should conduct an ***annual review*** of all Navy propellant stocks on hand (includes SMCA stocks which are under the Navy propellant program) against the P801 suspense manual and unincorporated NARs as a “reverse” means of assuring the stability of Navy propellants.

c. **DOCUMENT** your review of Navy owned/Navy tested stocks by listing each lot reviewed, and attest that lots so listed were not found in the P801 or NARs. This document should be dated and signed by the QASAS conducting the review and by the QASAS in Charge.

d. When warranted by local determination, stability information may be obtained from the NSWC/Indian Head contact in Appendix G.

CHAPTER 4 PROPELLANT REASSESSMENT PROGRAM

4-1. Program Definition and Application

a. The Propellant Reassessment Program involves the test and evaluation of propellant for which the original assessment, made at time of manufacture, has expired. The Program applies to Army-owned stocks of bulk propellant and finished but unassembled component charges such as charges for mortar and semi-fixed howitzer ammunition.

b. Prior to becoming an assembled component of a major end item, the Army wishes to be certain the propellant meets performance requirements in order to avoid the possible functional failure of the finished complete round. The reassessment test determines functional suitability quickly and inexpensively.

c. Propellants that are subject to reassessment testing are also included in the Propellant Stability Program and are cyclically sampled for stabilizer analysis through stockpile testing.

d. ***Please Note*** that propellant stability tests and propellant reassessment tests are conducted for two different purposes: one for safety, the other for performance. Each program operates independent of the other.

4-2. Propellant Reassessment Tests:

a. Are conducted only by request of JMC and are based upon requirements for future LAP or maintenance projects.

b. Consist of a series of laboratory tests and may include a ballistics test at a proving ground.

c. Result in approval or denial of **LOADING AUTHORIZATION** that is valid for a finite period of time, normally either two or five years.

4-3. RDT&E Propellant

The loading authorization requirements and time limits do not apply to propellants that are exclusively used for Research, Development, Test and Evaluation (RDT&E). However, personnel responsible for the RDT&E propellants may wish to have their Master, Reference or other propellant lots reassessed to assure confidence in the functional characteristics of their materials. Such Army RDT&E propellant users may contact the Surveillance Division at JMC to arrange for reassessment of their propellant. Reassessments are conducted at the owning command's expense.

4-4. Loading Authorization

a. As initially identified by a Notice of Ammunition Reclassification (NAR) and documented in Appendix I to TB 9-1300-385, Loading Authorization is the key element and controlling factor in the Reassessment Program. Only with valid loading authorization may bulk propellant or component charges be assembled to a complete round configuration.

b. The loading authorization affects the *Condition Code* of each lot as follows:

(1) With a current, valid loading authorization, the condition code of the propellant lot should be based upon results of visual inspection.

(2) When the lot has an **EXPIRED** or **UNKNOWN** loading authorization, the lot must be placed into CC-D, unless visual inspection warrants an unserviceable condition code.

4-5. Determining Need for Loading Authority (Yes or No)

a. **NO.** Separate loading propelling charges (FSC 1320) are finished, complete end items and **DO NOT** require loading authority prior to use (they have already been *loaded*).

b. **NO.** Propellant that is loaded into complete rounds (such as propellant loaded into 120mm tank ammunition or *assembled* to mortar rounds) requires no further validation prior to issue or use (such propellant has already been *loaded*).

c. **YES.** *Bulk propellant* and *component propelling charges* in FSCs **1310**, **1315** and **1376** require Loading Authority prior to use.

4-6. Time Limits for Loading Authorization

a. The original loading authorization for new propellant is usually five years, though some types of propellant and all propellants in Level C (fiber drum) pack are authorized for no more than two years. The following propellant types are authorized for loading for *not more than two years* regardless of type of pack:

(1) M5

(2) M10

(3) M26-series

b. Time limits for loading authorization of propellant lots due to reassessment are usually identical to those for newly manufactured lots.

(3) Lots stored in *metal containers* (cans or drums) or in *metal-lined wood containers* (Level A pack) are authorized for loading for **FIVE YEARS** from date of test (except those in paragraph 4-6a (1), (2), and (3) above).

(4) Lots stored in *fiber drums* (Level C pack), regardless of propellant type, are authorized for loading for **TWO YEARS** from date of test.

c. **EXCEPTION.** If the loading authorization expires *during* a maintenance program, a GS-12 or higher QASAS, from the servicing ammunition surveillance organization, *may* grant an extension. The loading authorization extension may be granted for up to 180 days to allow completion of the active maintenance program using the propellant lot in question. In all other instances, lots with expired loading authorizations cannot be loaded until reassessed.

4-7. How to Verify Loading Authorization

A listing of all applicable propellant lots that are currently authorized by JMC for loading is found in **Appendix I of TB 9-1300-385**. You can access this publication via the MHP website at https://mhp.redstone.army.mil/. CAC Login is required. The TB is listed under the “Notices” tab.

4-8. Condition Codes

Always verify the rationale for Condition Codes locally assigned to propellant lots that are subject to the Reassessment Program.

a. Condition Code “D” for this material means that the Loading Authorization, as listed in the TB 9-1300-385, has expired.

b. Any other serviceable Condition Code indicates that the lot is currently authorized for loading and use.

c. Failure to properly match the condition code with current load authority status can mislead ammunition planners when they are projecting stored assets for use.

4-9. Steps for Issue and Use

a. **Receipt of Materiel Release Order from NICP.** If the item requested is propellant or a propelling charge, check first to see if the item is subject to the Propellant Reassessment Program. If the answer is “yes,” there is a good possibility that you will have already pre-arranged the MRO through a telephonic query from the NICP; you will have been expecting this MRO. Whether pre-arranged or not, *first* confirm upon MRO receipt that the lot requested is subject to the Program and is actually on hand in the requested condition code at your installation.

b. **Review DSR file.** The DSR card should indicate the loading authorization expiration date. This in itself is not sufficient to allow issue. You must additionally check Appendix I of TB 9-1300-385.

(1) *Assure* lot has current cyclic inspection to meet shipping or use requirements.

(2) *Review* date of loading authority in TB 9-1300-385. Loading authority must be valid for a length of time sufficient to meet the lot's intended purpose. **For example**, let us say that seven months remain on the loading authorization, but you believe the item will not reach its intended destination in time for use. You must then take action to coordinate with the appropriate Item Manager at JMC or with the Surveillance Division at JMC (who will in turn coordinate with the item manager).

(3) *Locally validate* loading authority expiration date listed in the TB 9-1300-385. In the past, when the hard-copy Propellant Acceptance Sheets were the official record of load authority, incorrect dates were occasionally annotated on the forms, or they were not specific as to level of pack (which affects expiration date). Remember that loading authority **NEVER** exceeds **FIVE YEARS** from date of original assessment or reassessment and, if the propellant is of type **M5, M10,** or **M26-series**, the time limit never exceeds **TWO YEARS**. Additionally, if the propellant is in a level C pack loading authorization will never exceed **TWO YEARS.**

(4) **All OCONUS shipments** of bulk propellant or component charges **MUST** be cleared through JMC Surveillance Division prior to release for shipment. Only CC-A material is to be shipped, and the lot must be expected to have a minimum of nine months remaining on the loading authorization upon arrival at OCONUS destination.

(5) Should loading authority for the lot be expired or have insufficient time remaining to meet user requirements, place lot into the appropriate condition code (CC-D if expired loading authorization and otherwise serviceable) and contact JMC Surveillance Division for instruction.

(6) After the above requirements have been met the shipping procedure for the propellant or component charge lot *can now continue* as per any "normal" item shipment.

4-10. Selection, Preparation and Shipment of Samples

NOTE: *Samples should always be prepared and shipped per the direction of HQ JMC. The information below is an expansion of the directions in Chapter 13 of SB 742-1.*

WARNING! ***Don't Make Waste!*** If you are unable to locally dispose of less-than-full unit of issue propelling charges or increments that result from propellant sampling, **you must sample and ship only full units of issue!** (for example: one pound, one propelling charge, etc). We don't

want to generate hazardous wastes due to propellant sampling. Propellant residue that is generated at licensed and permitted locations should be disposed of as it is generated.

a. **Sample Selection.**

(1) Select five (5) containers as representative samples.

(2) Remove one pound of propellant from each container (the total sample will be five (5) pounds). If charge is of dual granulation, remove one pound of each component propellant lot from each container (total sample size of ten (10) pounds, five (5) pounds per component lot).

(3) If propellant is packaged as component charges, bags must be removed (if tools are needed, they must be of non-sparking type).

(4) After sample quantity has been removed, residue from component charges is authorized for disposal (see WARNING above).

b. **Sample Preparation.**

(1) Separately package and seal each one pound sample.

(2) Place each 1-pound sample in a plastic bag of the smallest size needed to hold the sample. Assure all personnel and equipment grounds are in place as may be required. Seal each sample bag by one of the three following methods:

a) Fold the bag opening over three times to close and apply two single wraps of tape that overlaps itself a minimum of one inch.

b) Gather the bag opening together and tie with a twist tie.

c) Use an anti-static **zip-lock** type bag:

11” x 10” zip-lock: NSN 8105-00-837-7756
12” x 12” zip-lock: NSN 8105-00-837-7757

(3) Place the cushioned samples in an M2A1 Small Arms Container per SPI ADP 1376-002.

(4) **Packaging materials and methods** that meet POP requirements include:

a) **Static dissipative plastic** barrier material, MIL-PRF-81705, NSN 8135-01-185-6816 (available by the roll)

b) **Conductive/velostat** material, MIL-B-82647, NSNs 8105-01-274-3585 & 8105-01-382-7369

c) **Barrier materials**, MIL-PRF-131, NSNs 8135-00-282-0565 & 8135-01-015-2810, may be heat-sealed and are good for overpacking the plastic bags.

d) **Metal drums**, **fiber drums**, or **metal-lined wood boxes** per MIL-STD-652 are acceptable if bulk containers are desired.

e) **Telescoping spiral-wound fiber container** having metal ends and double-foil inner wrap may be used for component charges and charge increments (but not if propellant is exposed). Add cushioning material to each end of the container to obtain a tight pack, and close with two wraps of tape.

f) **Plastic bag** or **Plastic wrap** (anti-static plastics) should be used to package large individual grains or stick propellant (such shipments are quite uncommon). Bag and tape-seal each grain or stick, or wrap and tape. Cushion as required with anti-static bubble-wrap or closed-cell foam material.

(5) Expose samples to the air for the minimum time needed to package. Do not desiccate samples. Type or print on a card the following information: NSN, lot number, name of the submitting installation, and test number. Tape this card to each 2-pound propellant sample bag prior to sealing. Include DSR card and ADC for each lot inside the total package, but not inside the individual propellant sample bags. **Dual Granulation Charges** require slightly different identification procedures than those above.

a) Pack dual granulation charges into separate bags, but on each identification card type or print the following information: NSN of the charge lot, complete charge lot number, lot number of the component propellant lot in the bag, the type of granulation of the lot (multi perforated [MP] or single perforated [SP]), name of the submitting installation, and test number.

b) Tape cards to sample bags as in paragraph 4-10b (5) above. Both component lots of a single propelling charge lot should be placed in the same outer pack.

(6) Do not print sample information directly to the inner pack, as damage to the packaging material may occur, to include flaking of aluminized bag material that destroys the written information. Tape ID cards to the propellant sample bags as described above.

d. **Sample Shipment.**

(1) After preparing and packaging the samples actual shipment may be delayed for an indefinite period. These delayed sample shipments can lead to ignored

or forgotten propellant samples in storage. For good management of all propellant sample shipments, the **following actions** are recommended.

(a) Establish a **local tracking action** on all prepared samples so that if Materiel Release Orders are delayed or cancelled, your local surveillance organization will be "flagged" to take appropriate closing action on the sample packages involved (i.e., local destruction, request disposition from JMC, etc.)

(b) **Insert a remark** into the DSR card that sample has been selected and packaged and is awaiting shipment. When samples are shipped, enter a comment with pertinent shipment information into the DSR.

(2) Samples will be shipped to the location directed by JMC per the Materiel Release Order (MRO), and will likely be one of the following:

Commander
Radford Army Ammunition Plant
Attn: JMRF-QA
P.O. Box 2
Radford, VA 24143-0099

Commander
ARDEC
Attn: RDAR-MEE-P
Picatinny Arsenal, NJ 07806-5000

(3) Special directions for the selection, preparation and shipping of ballistic samples will be provided by JMC as required.

4-11. Propellant Residue from Sampling

If you have generated propellant residue from your sample preparation, assure the residue (remains of propelling charge) is properly repackaged and identified on stock records if returned to storage. It is likely that such residue will be considered to be WMM per the Munitions Rule. You should plan to dispose of such residue either the same day that it is generated or as soon thereafter as possible, in order to avoid the responsibilities associated with the storage and maintenance of WMM.

CHAPTER 5 INSTALLATION PROPELLANT MANAGEMENT

Note: Specific instructions for the management of **U.S. Marine Corps** propellant stocks are found in Navy Ammunition Information Notice 021-2000. This AIN may be found in **NAVSUP P-801** Appendix A and is reprinted as **Appendix E of this Guide**.

Navy AINs have no designated expiration date.

5-1. SPP Sample Test Results

Test results will usually be submitted by the JMC to individual installations for the specific samples prepared and shipped by that installation. The DSR cards for those lots must be annotated with the test results.

a. SPP results for lots in Stability Categories “C” and “D” are sent from JMC via electronic message worldwide: Cat “C” for informational purposes and Cat “D” as a NAR suspension message.

b. Test results for other propellant lots in storage but not submitted by your installation for test (or in Cat “C” or “D”) will be included in the listing (“Propellant Database”) of all stockpile test results that is found on the MHP website (see paragraph 2b-2c). This all-inclusive list is of critical importance to the safe management of your propellant stocks.

5-2. Using the Propellant Database

a. Each lot of bulk-packed propellant, propelling charge, and bulk-packed component charges at your installation should be checked against the Propellant Database list no less frequently than once per year. Every lot on hand should be listed on the database with its appropriate stability information. Assure that the latest stability information has been entered onto each DSR card.

b. The technical staff at the APSL as well as the propellant program manager at JMC will have compared latest test results with earlier results of the same lot. However, it doesn’t hurt for you to do the same thing during your checks. Have a look to see if there is any sort of unusual or possibly disturbing pattern in the lot’s stability losses over time. If a significant (greater than 25%) loss of stabilizer has occurred since the previous test, then there *may be some cause for greater concern* than that which would be afforded a lot with a more gradual deterioration rate. You might, for example, have a lot that tested at 0.60% RES in 1998, but in 2004 the RES is found to be 0.29%. While we do not advocate routine local trend analysis of propellant stability, such an indication of rapid stabilizer loss warrants increased concern. When in doubt, contact the Surveillance Division at JMC.

c. *Lots not found on the Propellant Database list:* If an on-hand propellant lot (except Navy Materiel; see Chapter 3) *is not listed* in the database, it may not be included in the Propellant Stability Program as required. **You must:**

(1) **Check TB 9-1300-385** "Munitions Restricted or Suspended" to look for possible inclusion of the lot in PART 1 "Munitions Restricted or Suspended."

(2) If the lot doesn't appear in the TB, **contact the Surveillance Division** at JMC for specific guidance. The JMC will *probably* do *one* of three things:

- provide you with current stability status of the lot
- make arrangements to have the lot tested
- direct that the lot be demilitarized

d. If a ***Stability Category "D"*** lot is found during your check:

(1) **Check the DSR** to see if SC-D status has previously been identified.

(2) **Confirm that action** has been taken to destroy or otherwise demilitarize the lot ASAP *or* that demilitarization has already occurred.

(3) If action has *not* been taken or completed, or if the lot has *not* been previously identified as a SC-D lot, ***immediately*** begin taking steps necessary to assure rapid **demilitarization** of this propellant.

e. If a ***Stability Category "C"*** lot is found during your check:

(1) **Check the DSR** to see if SC-C status has previously been identified.

(2) **Confirm** that proper actions per SB 742-1 have been taken to obtain disposition from JMC; if SC-C propellants or propelling charges are not used or transferred to a qualified third party within 6 months, JMC will take action to place these stocks into the Resource, Recovery and Disposition Account, and destruction may be scheduled. *You* must identify these assets properly to assure JMC disposition action occurs.

(3) ***Take Special Note*** of lots that have had a *significant* (greater than 25%) reduction in RES since the last stability test that has lowered the Stability Category from "A" to "C." It is possible that such a lot is aging at a faster than expected rate and may require special attention from the PSP manager at JMC. Per the guidance of paragraph 5-2b above, you should identify these lots, with your concerns, to the JMC and insist upon a closing action from JMC to document your records.

5-3. Documenting Your Records

a. **DSR REMARKS.** Keep the DSR remark as short as possible while including all essential information. The information to be annotated includes the latest date of test, the MIN RES, and the Stability Category assigned based upon the MIN RES. This means that there are **three essential elements** to a properly annotated DSR for propellant stability. Example:

Propellant Stability: Last test December 2003, MIN RES 0.69%, SC-A.

(1) Should the MIN RES be lower than the RES from the last test you have identified, you may wish to include the RES from the last test as well as the MIN RES. If you choose to annotate both RES numbers, you need to increase the size of the remark to assure clarity. Example:

Propellant Stability: Last test August 2003, RES 0.84%. SC-A based upon MIN RES of 0.73% in Propellant Database from test year 1998.

(2) It is not necessary to annotate the results of the latest test more than one time per DSR. If DSR for your lot was annotated with the latest stability status in July 2000 and newer test results are not listed on the Propellant Database, you need not repeat the last stability entry. However, assure DSR record is made that the database was checked and that the stability remains the same. When sending DSRs to accompany a shipment, assure the last and most current propellant stability remark is included.

(3) The DSR entries may be as elaborate as you choose, but must contain the minimum information in the two examples above. Entries for Stability Categories "C" and "D" will require greater details.

b. **Annual Propellant Stability Review.** As mentioned in paragraph 5-2a above, all lots of bulk-packed propellant, separate-loading propelling charges, and bulk-packed component charges (stability-monitored propellant configurations fully described in Chapter 2, paragraph 2-4) require 100% screening for stability against the Propellant Database. The best time to conduct this review is as soon as possible after **1 December** each year, as the previous fiscal year's entire test results have been added to the MHP Propellant Database by this time. The review must be documented.

(1) A *memorandum* should be prepared which attests that a complete and thorough review of each applicable lot of propellant or propellant-loaded material in every owner account was checked against the stability information contained in the MHP Propellant Database. List all propellant lots checked by NSN, DODIC and lot number. A copy of this memorandum should be forwarded to the Propellant Stability Program Manager at the JMC Surveillance Office.

(2) The memorandum should be *dated and signed* by the QASAS or inspector conducting the review and by the **QASAS in Charge.**

(3) This annual stability review memorandum, together with the DSRs you have properly annotated, will serve as adequate records that you have taken the appropriate actions to manage the storage safety of your propellants stocks.

c. **Don't Forget Navy Propellant.** Conduct your annual screening of Navy-monitored propellant lots as discussed in paragraph 3-5 of this Guide.

5-4. Propellant Types of Greatest Concern

a. Some propellant types are more likely than others to become unstable during their expected normal storage life. Propellant formulations that have historically proven to be the most dangerous are types **M10** and various versions of **IMR** powders. This does *not* mean that little concern should be shown for other propellant types. It *does* mean that both M10 and IMR powders have repeatedly proven themselves to be "bad actors" and have self-ignited on multiple occasions at a variety of storage locations.

b. Pay particular attention, therefore, to the M10 and various IMR propellant types, especially when stored in bulk-pack configurations. **NEVER** allow them to be retained at your installation without a current, valid stability test that places them in SC-A or SC-C. Since the SPP test interval for a particular lot may not be known at the storing installation, any decision to retain stocks of these propellants that have still safe, but greatly impaired, levels of stabilizer may require the judgment of the QASAS in Charge.

c. Storage of bulk-packed propellant or bulk-packed component charges requires special vigilance, regardless of the propellant type. Inspect the condition of the packaging for these items to be certain of package integrity and that they have not been exposed to moisture; both these conditions may lead to rapid degradation of the propellant. If such conditions are found, you should request that a stability test be conducted.

d. Propellant types and their propensity to auto-ignite:

(1) ***Single-Base Propellants***. Formulations **M10** and **IMR** are the single-base propellants which are best known to exhibit the greatest likelihood of auto-ignition after depletion of stabilizer (DPA for these and most single-base types). **CBI** propellant, used in igniter pads in 155mm M4A2 and M119-series propelling charges, is very similar to M10 in composition and should be treated with respect equal to M10. While not commonly stored in bulk configuration except at a LAP plant, these propellant types are still occasionally found in bulk storage at non-manufacturing facilities, and they remain the most likely types to ever reach Stability Category "D."

NOTE: *Expulsion charges are frequently loaded with M10 powder.*

(2) ***Double-Base Propellants.*** To date, double-base propellants have been involved in few self-ignition incidents, and they are generally considered to be of less concern than single-base propellants. A notable exception is **M9 propellant.** A magazine fire that occurred at Hawthorne Army Depot in 1997 was attributed to the auto-ignition of bulk-packed component charges for 81mm mortar that were loaded with unstable M9 propellant powder.

(3) ***Triple-Base and Composite Propellants.*** The very low levels (usually less than 30%) of nitrocellulose in most of these propellant compositions help to make them a very low risk for auto-ignition due to depleted stabilizers. The generally large proportion of nitroguanidine in the formulation (usually more than 50%), with its characteristic hollow crystals, may also contribute to lowered rates of degradation for these powders. There have been no known instances of auto-ignition incidents of triple-base or composite propellants in storage.

5-5. Special Tips for Various Propellant Configurations

a. As a general rule, single-base propellant types M6 and M1 will exhibit similar aging profiles. The Army continues to maintain a large volume of aged M6 Propellant that has resulted in many lots of M6 with lowered levels of stability.

b. *Propelling Charges.* Most of the propellant lots which installations are required to monitor are assembled as separate loading propelling charges. Most propelling charges consist of M1 or M6 single-base propellant, although triple-base (such as M30) is common in some charges. Be sure to determine if the charge is of single or dual granulation. Check the ADC, too!

c. *Mortar Propellants.* When reviewing ammunition lot files, don't fail to look closely at FSCs 1310 and 1315 for bulk packaged mortar propellants.

(1) Mortar propellants (usually double-base) are normally found already assembled to complete rounds, and *WHEN SO CONFIGURED* do <u>not</u> require special concern for stability.

(2) When packaged in bulk, mortar component charges require the same stability monitoring as do separate loading charges or bulk-packed propellant.

d. *Bulk-packed artillery component charges*, such as the M67 charge for 105mm semi-fixed howitzer (FSC 1315) also require stability monitoring.

e. *Bulk-packed expelling/expulsion charges* that are loaded with other than black powder, such as the M10-loaded Expulsion Charge Assemblies (DODACs 1320-D017 & 1320-D018), have proven capable of auto-ignition and are included in the SPP. The magazine fire at Red River Army Depot in 1996 was attributed to auto-ignition of bulk-packaged expulsion charges.

5-6. The "5-Inch Rule"

a. For many years it was Army policy to consider propellants loaded in cartridge cases less than three inches in diameter to be incapable of auto-ignition. In these cartridges, the mass of the metal cartridge case and the air space surrounding the case provided enough flow of heat away from the relatively small mass of propellant such that it prevented the build-up of heat to the point of thermal instability; the air space acted as a "heat sink." Practical experience demonstrated that loaded propellants in such a configuration would not auto-ignite *even if the stabilizer were depleted*. These propellants, therefore, were not routinely included in the Army's propellant surveillance program.

b. As our common gun systems grew larger, we applied the tenets of the "3-inch Rule" to ever increasing calibers of ammunition. A generation ago, it was accepted practice to calmly apply the no-test provisions to 105mm ammunition, even though the cartridge cases were as much as *5 inches* in diameter! Still, our storage history and safety record for such material remained spotless.

c. Today, the Army has formally established the policy that we can safely forego field/stockpile monitoring of propellant for stability if it is loaded into ammunition items of gun systems that are ***smaller* than 5 inches** (127mm) in diameter. The **5 inches** refers to the **caliber** of the gun system, ***not*** the **maximum diameter** of the **cartridge case**. The quantity of propellant loaded into each cartridge is often as much as twenty pounds.

d. Although these propellants are not included in SPP testing, Master Samples of these propellants are routinely and regularly tested throughout their entire life cycle just as are all other Army gun propellants. Be assured that these uploaded propellants are not ignored, but are monitored for stability at the Army Propellant Surveillance Laboratory.

5-7. Receipts and Issues

a. *Propellant Receipts.* Upon receipt of propellants and propelling charges a check for stability is required as part of a complete Receipt Inspection. A stability check is also necessary if doing no more than an inspection for Damage in Transit. Detailed guidance on use of the Propellant Database and related files is contained in paragraph 5-2 above. **One of the following events** will result from the check:

(1) You find an acceptable stability level and category (SC-A or SC-C) for the propellant item in the Propellant Database.

Your Action: You will include this information in your DSR remarks.

(2) The propellant item is one that is managed for stability by the Navy (see Chapter 3).

Your Action: You will check Army and Navy suspension records to be sure that there has been no adverse action. Note DSR accordingly.

(3) You do not find the lot/index number in the Propellant Database (and it is not a Navy item).

Your Action: After checking the TB 9-1300-385 you will immediately contact the Ammunition Surveillance Division at JMC for guidance if it is not on either record. Note DSR accordingly.

(4) You find an unacceptable stability level (SC-D) and/or find the lot listed in the TB as hazardous for continued storage.

Your Action: You should immediately segregate and isolate the potentially unstable propellant. Contact the Ammunition Surveillance Division at JMC for guidance. Note DSR accordingly.

(5) You find that the lot has been suspended by the Navy for low stability and has been ordered for destruction.

Your Action: You should immediately segregate and isolate the potentially unstable propellant, then contact the Ammunition Surveillance Division at JMC for guidance. Note DSR accordingly.

b. *Shipping/Issuing Propellant.* A check for stability is a required part of the clearance process. Be sure to annotate the current Stability Category and MIN RES on the shipment planning worksheet. Detailed guidance on use of the Propellant Database and related files is contained in paragraph 5-2 above. Assure the accompanying DSR has been annotated with the latest stability information. Annotate the Stability Category and/or MIN RES on the DD Form 1348-1 as well.

5-8. Shipment of "Unstable, Condemned or Deteriorated" Propellant

a. The CFR 49, paragraph 173.54 (d) states, "Unless otherwise provided in this subchapter, the following explosives shall not be offered for transportation or transported: Propellants that are unstable, condemned or deteriorated."

b. **"UNSTABLE"** propellants are those that have deteriorated to the point that they are generating acrid, reddish-brown nitrous fumes under ambient temperatures. The visible presence of fumes may not always coincide with the acrid smell as the fumes may dissipate. The fumes signal the onset of instability. Unstable propellant may not be transported on public roads, rails or waterways, and it is prohibited from transport by air.

c. When levels of stabilizer in lots of propellant become so low as to fall into SC-D, SB 742-1 states that they "present a potential safety hazard and are unsafe for

continued storage in bulk, bulk-packed components, or as separate loading propelling charges." It is important to note that while category "D" propellant is considered seriously deteriorated and is condemned for further retention or military use it is NOT considered "unstable" unless it is fuming at ambient temperature.

d. The lowered level of stability that must be reached by a deteriorated propellant to be placed into SC-D has been set at a level that allows the services a "safe" period of sixty (60) days from the date of NAR issue for the demilitarization of the SC-D propellant. Unless other directions are specified, the NAR will state that any storing installations with the permanently suspended propellant are allowed 60 days for its demilitarization. Demilitarization consists of either Resource Recovery and Recycling (R3) action or treatment (these terms are explained in Chapter 6). The action you take will usually consist of one of the following:

(1) **Destruction** by burning at the storing installation.

(2) **Shipment** to a location that is licensed and capable of destroying the propellant by burning.

(3) **Movement** to a propellant conversion or reprocessing facility that is capable of quickly rendering the propellant into separate, stable compounds such as nitrogen-based fertilizers, or otherwise made safe, such as blending with other energetic materials to make slurry explosives or blasting gels, within the 60-day window.

d. Propellant that is in **SC-D** and has **exhausted** the **60-day demilitarization** window requires urgent demilitarization action prior to the onset of instability. Transportation of such propellant over public transportation routes (road, rail, air or waterway) must be carefully coordinated with the Surveillance Division at JMC. A physical inspection of each container should be completed immediately prior to any shipment. Close tracking of the shipment from origin to destination is essential since the precise date the propellant may become unstable is unknown. Such propellants will likely be designated WMM by the Designated Disposition Authority (DDA) per the Munitions Rule Implementation Policy (MRIP).

e. Propellants with **unknown levels** of stability must be determined to be stable for shipment to prevent the shipper from violating the Federal Regulation noted in paragraph 5-8a. above. **Unless the stability is at a known, tested level,** shippers are unable to measure the extent of propellant deterioration. *On an **exception** basis and with the **written approval of JMC**, propellant of unknown stability **may** be shipped if each container of propellant has been individually examined to assure that it is not unstable at time of shipment.*

CHAPTER 6 DEMILITARIZATION

WARNING

Remember to take special care if generated propellants are either of types *M10* or *IMR.*

These propellant types have been known to auto-ignite soon after reconstitution into bulk-pack configuration.

6-1. What is Demilitarization?

a. Demilitarization is the process of removing military characteristics from materiel. We demilitarize our propellant either by use of a *Resource Recovery and Recycling* (R3) method, or through *treatment*. R3 involves reuse of the demilitarized materiel, while treatment involves the destruction of it.

(1) **Resource Recovery and Recycling (R3)** methods for propellant include conversion to fertilizer, nitrocellulose extraction, reblending for commercial or military use, reuse as a propellant with or without physical alteration for commercial or military use, use as a component of blasting gel or slurry explosive, etc. R3 involves recovering and reusing all or a part of the propellant. Propellant for which R3 actions are designated are not considered to be WMM.

(2) **Treatment**, a term that comes to us from the world of environmental science, involves partial or total destruction of the material. Treatment may include the recycling of some component materials, but for propellant the method of treatment most commonly used is total destruction by burning. Propellants that undergo treatment are usually those that have been declared WMM.

(3) **Disposal** refers to the removal of military munitions from government ownership and control.

6-2. Generating Propellant

a. Propellants that are generated from downloaded munitions require careful attention. Although Master Samples of these lots may have been monitored in the Master Propellant Program, it is unlikely that there have been *any* tests of the propellant downloaded from fixed rounds. The stability of the propellant generated from download may be significantly different from that of the Master Sample; it may be significantly lower. The stability of propellant from different segments of the same lot of ammunition may show considerable variance due to differing environmental conditions each lot segment has experienced. If the generated propellant lot is not included in the MPP, that lot will have a stabilizer content and projected safe storage life that is *absolutely unknown*.

b. For Army-managed propellants, JMC disseminates the Commander's Policy Memo titled "Demilitarization Priorities for Excess and Obsolete Conventional Ammunition." This memo details Army policy regarding the actions necessary for the demilitarization of propellant the Army does not wish to retain, to include propellant that is generated from download of fixed rounds. Figure 1, at the end of this chapter, is a decision chart based upon the JMC policy. Use the Figure 1 decision chart to assure you comply with the Commander's Policy whenever propellants are generated from downloaded munitions.

c. *Propellant Generation Planning Actions:* Recommended actions prior to the start of any operation that results in the generation of propellant include:

(1) Review DSRs of complete round lots to determine the propellant type, age, and lot/index number. Check the ADC to verify information and to ascertain if bag charges are/are not dual granulation.

(2) Compare lot/index numbers with the MHP Propellant Database. If listed, take further action regarding lot retention based on known stability. If the lot is not listed in the database, determine disposition of generated propellant in advance. Don't allow unlisted propellant to accumulate without an approved disposition plan.

(3) If propellant stability cannot be determined prior to operation *and* propellant is to be destroyed or converted locally as it is generated, assure the destruction or conversion takes place within 60 days of collection from breakdown of complete rounds.

(4) If the stability of the propellant cannot be determined prior to the start of the operation, and if the propellant is to be retained for more than 60 days for *any reason* (reuse, future sale, fertilizer conversion, destruction delay, pending shipment elsewhere for destruction, etc.), a stability test must be conducted. An Ammunition Peculiar Equipment (APE) 1995 Series Near Infrared (NIR) Propellant Analyzer test set may be used (when available; see paragraph 6-3 below) or you may request the JMC Ammunition Surveillance Division arrange a test.

(5) Bulk Propellant of either unknown stability or Category "D" stability that is retained for any length of time greater than 24 hours *must be isolated* from other ammunition and explosives (i.e., placed in a dedicated magazine).

d. *Funding* to pay for the costs associated with propellant stability management at installations that generate propellant should be derived from the overall funding for each ammunition operation. Ammunition Surveillance personnel should assure that these requirements and costs are included in installation planning for all operations that result in the generation of propellant.

6-3. On-Site Stability Tests Using APE 1995 NIR Propellant Analyzer

a. The APE 1995 gives individual installations the in-house means to immediately screen propellant for stability whenever they choose. The Joint Ordnance Commanders Group Quality Assurance Sub-Group Joint Propellant Safety Surveillance Board (JPSSB) has determined that the APE 1995 M1 is suitable for use as a field-screening test. In conjunction to this endorsement, the APSL considers the APE 1995 sufficiently accurate to screen demilitarization stocks for safe retention of up to 12 months or immediate destruction. Except when otherwise directed, stability test results gained with the APE 1995 make unnecessary the sending of demilitarization stock propellant samples to the APSL at Picatinny Arsenal. As the JPSSB endorsement states, the APE 1995 M1 is only suitable as a screening test and not intended to be used in lieu of the PSP. If storage of an APE 1995 tested lot, that tested satisfactory, is expected to exceed the established 12 month timeframe, a sample will be sent to the APSL at Picatinny Arsenal for testing two months prior to expiration of the initial 12 month allotment and the lot will be absorbed into the PSP.

b. The test set uses Near Infrared (NIR) technology to analyze propellant samples. The equipment is simple to use. After scanning the propellant with the NIR light, test results are produced almost instantly. Dozens of individual samples can be tested daily since the test of each sample takes only a few minutes time from start to finish. The APE 1995 may be used to test only the types of propellants for which it is calibrated, but those are the propellants that make up the bulk of our propellant stockpile. A significant positive feature of the APE 1995 is that it is totally non-destructive to propellant. No propellant is consumed as a result of stability testing. In addition, the test is completely automatic once a sample is placed inside the machine.

c. The APE 1995 determines if the stabilizer content is sufficient to "Pass" or if it "Needs Further Testing".

(1) The "Pass" result means that the lot is acceptable for retention for a time period not to exceed 12 months. Pass/Fail test results will be documented on the respective DSR card or retained for a minimum of 3 years.

(2) The "Needs Further Testing" result means that a sample of this propellant needs to be submitted to the APSL for testing. JMC will authorize sample selection and shipment of required samples.

d. The APE 1995 NIR Propellant Analyzer is available through the Ammunition Peculiar Equipment program. Formal training of operators is available through the APE program and is arranged at time of initial equipment issue.

6-4. Propellant Retention

a. All unwanted, excess propellants and especially those which have been generated from download of fixed rounds should only be retained in storage for as long

as it takes to effect disposition (i.e., disposal, recycling, etc.). Downloaded propellant should be scheduled for disposition within one year of generation. Such disposition might be through sale, through local destruction, fertilizer conversion, or through shipment to another location for destruction or R3 action. Propellants that are of a high order of stability, such as most triple-base propellants, will likely receive the lowest priority for demilitarization action. Since stable propellants can be safely retained for a longer period, more time is available for the pursuit of R3 options in lieu of destruction by burning.

b. When retaining any unwanted, excess propellants (either those generated from download or those already in bulk, bulk-pack configuration, or as separate-loading charges), the following **rules** apply:

(1) Propellant cannot have been downloaded from mortar rounds.

(2) Storage history of propellant must be known, and the history must not indicate long-term (one year or greater) exposures to high (greater than 120^0F) heat or excessive moisture.

(3) Propellant must be identifiable by manufacturer's lot/index number.

(4) RES level of propellant must be greater than 0.20%.

(5) SPCF/NACO/BS-NACO propellants additionally must demonstrate a fume time of greater than 30 days.

6-5. Propellant as Waste Military Munitions

a. Under most circumstances, bulk propellants, bulk-packaged component charges and separate loading propelling charges will be designated WMM by the DDA *after* the expiration of the 60-day disposition/demilitarization period that follows the issue of a NAR that has permanently suspended the propellant due to its SC-D status. If the disposition/demilitarization period is extended (per paragraph 6-7b (3) below), then the propellant will probably not be designated WMM until the expiration of the extended period.

b. During the period allowed for disposition/demilitarization, effort should be made to offer the propellant to a facility/vendor capable of resource recovery and reuse (R3). Suitable R3 methods for SC-D propellant may include conversion to fertilizer, nitrocellulose extraction, or use as a component in blasting gels or slurry explosives.

c. For propellants owned and managed by the United States Marine Corps, propellant items will be designated as WMM immediately upon issuance of NAR and must be managed accordingly. The authority for this guidance, at time of this Guide's publication, is Navy Ammunition Information Notice (AIN) 021-2000, "Propellant and

Propelling Charges Management," reprinted in this Guide as Appendix E. Navy AINs have no designated expiration date.

d. After propellants have been designated WMM by the owning service DDA, they will be managed per CFR 40, 12 AUG 97, "Title 40, Protection of the Environment, Subpart M, When WMM Become Solid and Hazardous Waste Subject to Regulation," and the DoD Munitions Rule Implementation Policy (MRIP).

e. After propellants have been designated WMM by the DDA Condition Code V will be assigned. CC-V will be assigned *only* to WMM, and *only* by direction of the DDA.

6-6. Disposal of Propellant by Sale or Release to Commercial Vendor

a. Propellant may not be released from government custody unless the stability level is known to be at a level safe for continued storage or transport on public roads (Stability Categories “A,” “C” and, under circumstances defined in paragraph 5-8, Stability Category "D"). SPCF/NACO/BS-NACO propellants additionally must demonstrate a fume time of greater than 30-days.

(1) If the original lot/index number is not known, the propellant cannot be sold or released because the stability level of such propellant is indeterminable.

(2) Lot integrity must be maintained for propellant that leaves government custody.

(3) New and/or evolving methods in the ways in which propellants are reused and/or reprocessed may result in *special situations* that will require specific case-by-case guidance from the JMC or higher headquarters. For example, a *special situation* may exist if propellant of indeterminable stability is to be processed by a commercial vendor within the boundaries of the propellant’s current government storage area.

b. In most instances, propellants that are listed in the MHP Propellant Database in SC-A as having been tested within the past five years are suitable for sale or release to a commercial vendor without additional stability testing. Even so, the JMC Ammunition Surveillance Division must clear each lot of propellant that is offered for sale or release to a commercial vendor.

6-7. Demilitarization

a. While demilitarization by burning is still a widely used method employed by the Army to dispose of unwanted, excess and condemned propellant, other options are becoming increasingly available and viable. Sales of bulk propellants to commercial vendors have become commonplace, and we may soon have the capability to convert considerable quantities of propellant into fertilizer.

b. A potentially hazardous propellant is one that has experienced a fume time of less than 30-days and/or has displayed an RES of less than 0.20%. When potentially hazardous propellants are identified you may have little option but to demilitarize them by burning. Such demilitarization usually consists of burning the propellant above ground in the open air in specially constructed steel or refractory-lined steel pans, often built to the specifications of DAC drawing number D 28620 ACV00095. This drawing can be requested through the MHP website at https://mhp.redstone.army.mil/ under the ASIS Tab. A Common Access Card (CAC) Login is required.

(1) A "demilitarization" or “disposition” period of 60 days is normally stipulated for propellants that are potentially hazardous. The Navy or Army NAR that suspends such propellants may state that these potentially hazardous propellants are considered sufficiently stable for movement on public transportation routes to a designated demilitarization (R3 or treatment) site for a period of up to 60 days from the date of the NAR. **NOTE:** *See paragraph 5-8 above for shipment of SC-D propellant beyond the 60-day period.*

(2) Installations that receive an urgent NAR that calls for the demilitarization of potentially hazardous propellant in storage at their location must act quickly. Any perceived problems that might affect an installation’s ability to complete such action must be brought to the immediate attention of the JMC Surveillance Division.

(3) Under special circumstances, and on a case-by-case basis, JMC may allow for a storage period for propellant in SC-D *greater* than the 60-day period designated if additional testing indicates that the propellant may be safely stored for an additional short interval of time, normally an additional 30 days.

c. *EPCRA Toxic Release Inventory (TRI).* When disposing of propellant by burning, do not fail to meet the mandatory tracking and reporting requirements of Executive Order 12856, “Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements.” Access to and use of MIDAS on-line is your best method of gaining detailed information on various propellant compositions; MIDAS is described in paragraph 6-8 below.

(1) The best tool available to assist you in calculating data for your TRI reports is the Munitions Analytical Compliance System (MACS), used in conjunction with MIDAS and developed by the Technology Directorate of DAC. The MACS offers a consistent data source with the benefit of automatic calculations. Access to MACS and MIDAS are detailed in paragraph 6-8 below.

(2) If you have a propellant type for which you have not been able to identify the chemical composition, you should contact one of the Propellant POCs identified in Appendix G of this Guide.

6-8. Using MIDAS for Characterization Data

a. The Munitions Items Disposition Action System (MIDAS) is a *great* tool for gaining characterization data for all types of propellants. MIDAS maintains detailed chemical composition information for over 6,100 different ammunition items, to include high explosives, NC-based propellants, rocket and missile propellants, complete rounds, etc.

b. MIDAS is accessed on-line at https://midas.dac.army.mil/. Use of the site requires CAC login, registration and issue of a password, but the registration system is both simple and quick. Once you gain access into MIDAS you will find a wealth of information to include detailed information for your propellant queries in a variety of Standard Reports. Standard Reports are tailored to specific needs, and MIDAS enables users to quickly extract comprehensive information in various formats.

- Detailed Structure Report
- Detailed Structure Report (Less Bulk Items)
- Propellant, Explosives, and Pyrotechnic (PEP) Structure Report
- Primary Component and Parts Report
- TDP List of Drawings
- Usage of an Item
- Packaging Report
- Toxic Release Inventory (TRI)
- RRDA Inventory Report
- Munitions Compounds Parts (MCP) Report

c. In Appendix D of this Guide you will find nominal data on the chemical composition of the more common propellants. This appendix can be used for "quick check" work, but whenever more precise and authoritative information is required, you should refer either to the Propellant Description Sheet or to the data found in MIDAS.

PROPELLANT DOWNLOAD DECISION CHART

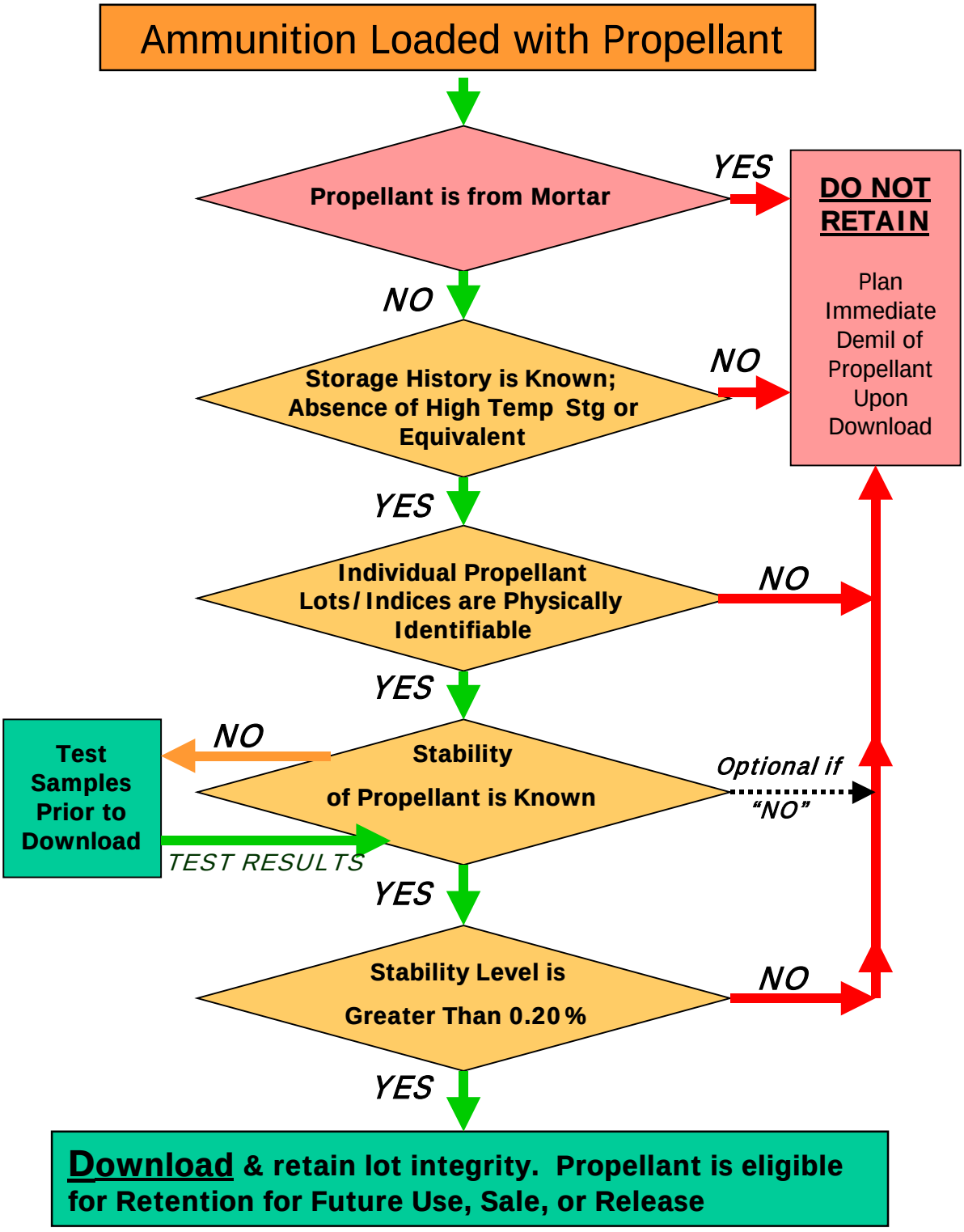

Figure 1

CHAPTER 7 PROPELLANT SAFETY MANAGEMENT FOR ASP, TRAINING RANGE, AND COMBAT THEATER

7-1. Retail and User Level Management

Propellants and propelling charges are not all stored in huge storage depots and manufacturing plants. When issued to the soldiers at retail and user level, propellants are located at ammunition supply points (ASP), basic load ammunition holding areas (BLAHA), in use on training ranges, or in the hands of the deployed troops in ammunition holding areas (AHA) or field ASPs in places like Afghanistan and Iraq. The stability of on-hand propellant must remain a consideration in these storage and handling environments.

7-2. ASP – Level Management

a. When propelling charges are shipped from a manufacturing plant or storage depot (wholesale level) to an ASP (retail level), the propellant is expected to arrive with a clean bill of health regarding safe stability status. The depots and plants follow the management rules and procedures that are contained in the previous chapters of this Guide. Once the propellant is shipped to *Retail level* storage at an ASP, the propellant is not expected to have a long life, as it has been ordered and stocked at the ASP based upon projected training requirements. Since consumption of the propelling charges is expected within a few months to a year from time of receipt, management of propellant for stability at the ASP/retail level should be rarely needed. Unfortunately, such is not the case. Propelling charges will often remain in storage at an ASP for several years before finally being issued and fired, shipped to another ASP for cross leveling or returned to a depot as excess.

b. Management of your propellants for safe stability status should resemble the procedures described in chapter 5 of this Guide as much as possible and practical. If your installation's ammunition operation has a QASAS assigned, he or she will already know how to manage the propellant program and will be sure that all your propellant stocks remain safe to store. However, if you *don't* have a QASAS on hand or making regular visits, then you will have to manage the program yourself. The steps that follow in 7-2c through 7-2l represent a minimal *bare bones* program.

c. **Get the MHP Propellant Database.** This automated stability list is accessed through the MHP webpage per the procedures outlined in paragraph 2b-2c. Once you have gained access to the list, you can use it at least once per year or when new propellant is received to check the stability status of propellant and propelling charges you have on hand, to include:

(1) DODICs DA12, DA13, D532, D533, D540, D541 and similar separate loading propelling charges

(2) DODICs C709, C279, C436 and similar bagged component charges for mortar and 105mm when packed in bulk containers. When these charges come already assembled to complete rounds, there is no need to check for stability; the propellant will stay safe.

(3) Expulsion/expelling charges or other similar propellant-filled components when stored together in bulk pack (more than one pound of propellant per package). This does NOT include line cutters and other propellant actuated devices.

(4) Bulk packaged propellants in Federal Supply Class 1376.

Note: 155mm Separate Loading Propelling Charges, first on the above list, are probably the only kind of propellants most ASPs will have on hand.

d. **Check for Unstable Lots First.** Go to the MHP web site and open the propellant database. There are a lot of ways to get the information you need because there are a lot of ways that you can get the propellant database list to display. Do it any way you like, but probably the easiest way to check propelling charge lots that have a DODIC is to open the DODIC query and type in your DODIC (e.g., D541, D533, etc.). Scroll until you find your lot number, then look until you find the column titled "CAT." This column contains the stability category for your lot of propellant. The propellant Stability Categories (SC) are:

"A" – ACCEPTABLE STABILIZER LOSS. SC-A lots are "good to go" and are safe to keep in storage.

"C" – SIGNIFICANT STABILIZER LOSS. SC-C lots are still safe to keep in your magazines, but they may reach an unacceptable stabilizer level within one year.

"D" – UNACCEPTABLE STABILIZER LOSS. **DANGER!** SC-D lots are *unsafe* to keep. These propellants or propelling charges must be *demilitarized* within 60 days after you are told they are in Cat "D."

e. "**Quick Check" for Categories C and D.** There aren't very many propelling charge lots in the Army inventory that are in either SC-C or SC-D. We get rid of the SC-Ds fast, and the SC-Cs don't stay for more than a year or so. This means that you can go through the entire list of these two categories in just a couple of minutes.

(1) In the propellant database, click the query for "Stability Category" and enter the letter "D." You will see a list of all the Army's SC-D propellants.

(2) **Scroll** down the list to see if any of your lots are there.

(3) **Repeat** the process for SC-C.

(4) **Complete** this check for SC-C & SC-D lots at least once per year. Any time you receive a new lot in your ASP, check it against this list, too.

f. **If you find a Stability Category D Propellant,** you must take *immediate* action to demilitarize it, because SC-D propellant is known to be reaching a dangerous level of stability. Request disposition authorization from JMC Ammunition Surveillance office immediately (see Appendix G).

g. **If you find a Stability Category C Propellant,** you must "flag" that lot for priority issue and make every effort to use up that lot within one year. If you still have it after a year, you should check with the PSP manager at JMC (Appendix G) for disposition.

h. **Check the Rest of Your Propellant.** After you have checked through your propelling charges for Stability Categories C and D, you can assume that lots not in those lists must be SC-A. Still, they need to be checked against the list for you to be sure, and also to verify that your propellant lots *are* listed on the database. If you have any propelling charge lots that aren't listed on the database, you can't know what the stability level might be.

i. **If a Lot is *NOT* Listed on the JMC Propellant Database,** you should go to TB 9-1300-385, "Munitions Restricted or Suspended," Part 1, and see if the lot is listed there. If it can't be found in this list either, then you must immediately contact JMC for disposition. You *must not* keep propellant of unknown stability in your ASP.

j. **Annotate your Records.** The TB 9-1300-385 (accessed through the MHP website) should always be used to check your propellant lots. Annotate the results of your propellant stability check to each DSR card. Keep the DSR remark as short as possible if the lot remains in Stability Category "A," such as **"Propellant Stability Test performed 1997, 0.93% RES, SC-A."** ("RES" is the Remaining Effective Stabilizer)

(1) If you *don't* maintain DSR cards, you should make an entry like that above to whatever sort of lot record file you keep, whether it be receipt documents, card file, or what have you. If you maintain a permanent lot file of some sort, the propellant stability information should be annotated to it. However, be aware DSR input is mandatory per the requirements of SB 742-1 and DSR entry is now mandated through the Munitions History Program (MHP). The Web-site for MHP can be found at https://mhp.redstone.army.mil/.

(2) If you don't keep any sort of lot history records, as an absolute minimum you should prepare a memorandum for record. The memo should explain that you have checked all your lots against the JMC propellant database on such-and-such a day. It should list each lot checked by DODIC and lot number and say that all were found to be in Stability Category A or, if any were not, identify the lots that were in categories C or D and document what you did about it.

k. **Notices of Ammunition Reclassification (NAR)** must also be regularly received and checked for suspensions against propellant lots that have low stability levels. The TB 9-1300-385 (accessed through the MHP website) should always be used to check your propellant lots.

7-3. Propellant Residue at Training Ranges

a. Background

(1) Gun crews in the field often adjust (i.e., reduce) propelling charges at the firing point from their original configuration. In wartime, residue from this adjustment is routinely destroyed through burning on the ground at a location contiguous with the firing point, as the residue no longer possesses its original military value. The immediate destruction of the residue removes a hazardous material from the crew area, eliminates the need for any further logistical considerations for the residue, and prevents the material from being used by the enemy or presenting a potential danger to non-combatants who may inhabit the area.

(2) The destruction of propellant residue is such a normal part of the gun firing process in wartime that most training activities include this action in their training plans. The act of destroying propellant residue incident to training is ***not*** considered demilitarization.

(3) The Military Munitions Rule (MMR), Chapter 3, paragraph B1a, specifically authorizes such activity, stating “During live fire training exercises, not all propellant charges or charge increments are used. Unused propellant presents an explosives safety hazard and a tactical threat in combat situations. The training of personnel in the safe management and expedient destruction of unused propellant by open burning is a required element of training and not a waste management activity.”

(4) By destroying unused propellant by open burning as an essential element of training during the firing exercise, the need for further logistics, safety and surveillance efforts are eliminated. In addition, the potential need to treat this material as -WMM- is avoided. The destruction of propellant residue by burning as an accepted part of the training activity is not an army requirement but is a preferred and recommended option.

(5) When unused propellant residue is used for training Explosives Ordnance Disposal (EOD) and similar personnel, whether such training occurs on an EOD range, on test or training ranges, or at permitted open burning/open detonation (OB/OD) sites, such use is considered to be a part of the munitions’ intended purpose. Propellant range residue that is scheduled for use in training EOD and similar personnel is NOT to be considered WMM, per the MMR, Chapter 3, paragraph B1b.

(6) Some installations utilize burn pans to accomplish the burning of unused propellant. Burn pans are not required and will not be available during contingency

operations. Additionally, residue remaining in the burn pans after burning is HAZARDOUS WASTE and must be collected, turned in, managed and disposed of as hazardous waste.

b. **Retention of Range Residue**

(1) Military commands may choose to retain the propellant residue and assure that it is demilitarized in another way, either through treatment or through resource recovery and recycling (R3). Treatment of propellant is usually accomplished through burning, while R3 options include methods such as reuse as a component of blasting agents, conversion to fertilizer, or reconfiguring and reuse as gun or small arms propellant.

(a) Excess and unneeded propellants for which a demilitarization method involving R3 is scheduled or planned are *not* considered to be WMM.

(b) Excess and unneeded propellants for which a demilitarization method involving treatment (that is, destruction rather than recycling or reuse of any or all of the propellant) is scheduled or planned *will* usually be considered WMM, unless it is scheduled for use in another training activity (i.e. EOD), per 7-3.a.(5) above.

(2) Propellant and propelling charges that are retained as range residue rather than burned in conjunction with the training mission will require demilitarization by one of the two categories of demilitarization (R3 or Treatment). Those propellants which are identified by a suitable authority (i.e. HQ JMC) for retention or shipment to another facility in order to effect an R3 method of demilitarization will not be considered WMM and may be retained in storage pending R3 for as long as necessary if the following Army requirements are met:

(a) Lot identity is maintained and all the propellant retained is physically identifiable by propellant lot or index number.

(b) Remaining Effective Stabilizer (RES) level of each lot of propellant is known and is suitable for retention per the requirements of SB 742-1, Chapter 13.

(c) Propellant is packaged per paragraph 7-3c (2) below.

(3) Retention of propellant range residue other than that described in 7-3b (2) above is specifically limited as follows:

(a) All propellants and propelling charges for which lot identity cannot be established are considered to be potentially unstable and must be demilitarized within 60 days. Propellant with lost lot identity generally may not be shipped to another location for demilitarization without specific authorization from HQ, JMC. If shipped, such shipment must allow for the receipt of the propellant by the gaining activity to accomplish demilitarization within the 60-day window.

(b) Any retained propellant with an RES level that is less than 0.20% must be demilitarized within 60 days. This RES level constitutes Stability Category D (SC-D) and, if shipped, such shipment must allow for the receipt of the propellant by the gaining activity to accomplish demilitarization within the 60-day SC-D notification window.

(c) Propellant lots with an unknown storage history or those that have been exposed to extended high temperatures or moisture must be demilitarized within 60 days. Such propellants generally may not be shipped to another location for demilitarization without the specific authorization from HQ, JMC. If shipped, such shipment must allow for the receipt of the propellant by the gaining activity to accomplish demilitarization within the 60-day window.

(d) All types of propellant removed from mortar ammunition must be demilitarized within 60 days. Such propellants generally may not be shipped to another location for demilitarization without the specific authorization from HQ, JMC. If shipped, such shipment must allow for the receipt of the propellant by the gaining activity to accomplish demilitarization within the 60-day window.

(4) If the WMM-owning/storing installation operates a permitted OB/OD demolition range, the WMM should be locally demilitarized within the 60-day window.

(5) *Propellant is considered **unstable*** when it generates acrid nitrous fumes under ambient temperatures. Unstable propellant may *not* be transported on public road, rails or waterways, and is prohibited from air transport. Unstable propellant should be demilitarized immediately.

c. **Demilitarization and Disposal of Range Residue. Demilitarization** is the process of removing military characteristics from materiel. **Disposal** refers to the removal of military munitions from government ownership/control. A detailed explanation of these terms is found in paragraph 6-1 of this Guide.

(1) Propellants and propelling charges for which a recycling or reuse program has not been identified are generally not considered to be candidates for the R3 methods of demilitarization. To date, mortar propellants that have been removed from complete rounds have not been identified for R3 programs nor have any R3 programs been projected. The method of demilitarization for mortar propellant range residue is treatment (i.e., destruction, usually by open burning).

(2) **Prior to shipment** to another location for demilitarization, range residue propellant *must* be packaged either in its originally configured pack (such as steel cylindrical containers containing separate loading charges) or must be *repackaged* by a method that has been approved by a competent authority as meeting applicable requirements (49 CFR, UNO), and must possess a **valid hazard classification** (interim or final) as packaged.

7-4. Propellant in the Combat Zone

a. **Propellant Stability**. Most of our artillery and small arms propellants contain a high percentage of nitrocellulose (NC), sometimes as much as 98 percent of the total propellant composition. NC is made of nitrated cellulose fibers, an organic material. Organic materials naturally deteriorate and decompose. As NC decomposes, it creates heat, and can sometimes create enough heat to cause the NC to auto-ignite. We add chemical compositions called stabilizers that act to slow down the decomposition process by absorbing the heat-generating decomposition products. At some point the stabilizers may become saturated and the propellant will begin decomposing at a faster rate and may generate its own heat to the point that it is near ignition temperature. When propellant reaches a point that auto-ignition is imminent, we consider it to be *unstable*.

b. **Propellant Auto-ignition.** U.S. Army propellants are constantly monitored and tested for stability levels. We know that the propellants you were issued had good and safe levels of stabilizer at the time of issue, and that they have been monitored by our APSL on a regularly recurring basis. Even under extreme ambient conditions, any of your propellants should remain safe and stable for many months, at a minimum. Many factors must be considered when evaluating the auto-ignition potential of any NC-based propellants, whether of U.S. or other manufacture. The most important factors are the composition of the propellant, the mass (volume, quantity) of the propellant, and the storage environment.

(1) **Composition:** In general, single-base propellants, those whose composition consists of more than 80 percent NC, have the greatest potential to auto-ignite because there is a greater percentage of auto combustible material in their makeup. One notable exception is the double-base (NC plus nitroglycerin) propellant powder M9, which is commonly used as the propelling charge for mortar ammunition and has been known to auto-ignite in storage.

(2) **Age:** The older the propellant, the more it will have already decomposed. Propellants decompose at different rates, depending upon composition and even depending upon individual quality factors during manufacture. Some NC-based propellants might decompose to the point of auto-ignition in less than ten years, but most that are used for U.S. military purposes have an expected life of greater than 20 years and may last decades longer. The time to potential auto-ignition is reduced by the amount of time that has passed since manufacture. The elapsed time brings you closer to the end of the propellant's safe life, though the date and time of that end can never be perfectly predicted. For most of our artillery propellants, if they are not more than ten years old, you can consider them to be very close to "as new" with regard to stability levels.

(3) **Mass:** In order to auto-ignite, the propellant must reach an of ignition temperature of several hundred degrees Fahrenheit. The actual value depends on propellant type. In theory a small amount of propellant can auto-ignite at ambient

temperature. However, this has never been known to occur in reality. In practical application, we consider that any propellants that are currently loaded into fixed and semi-fixed rounds (to include mortar) for gun systems of less than 5" (127mm) in diameter do not have sufficient mass to auto-ignite. We assume that proper packaging and storage conditions remain in place.

(4) **Storage Environment:** The two most important storage factors are moisture and temperature. Propellant decomposes more quickly under wet or moist conditions and increasing the temperature accelerates the aging process. For many decades we considered propellant that remained stable at a constant temperature of 150^0 F (65.5^0C) for more than 30 days was stable enough to remain in the service stockpile. Although we no longer use this as a test standard (except for SPCF/NACO/BS-NACO propellants), there is no doubt that we have many propellants in the service stockpile that would be prone to auto-ignition within a period of several weeks if maintained at temperatures at or exceeding 150^0 F. Propellants that are stored in the following configurations *are considered capable of auto-ignition* if stabilizer becomes depleted:

- Bulk-packed loose grains, sticks or sheets
- Bulk-packed bagged charges (howitzer and mortar propellants)
- Separate Loading propelling charges (155mm, etc)
- Bulk-packed component charges (expelling/expulsion charges, etc)
- Separated Ammunition charges for Navy gun systems 5" or greater

c. **Dangers of Propellant Auto-ignition in the Extreme Field Environment (such as field storage in Iraq).** Field storage environments in an active theater of war may be such that propellants will be exposed to elevated temperatures for a sustained period of time so that auto-ignition of U.S. propellants could occur with some propellant types, perhaps within a few months of introduction into the theater. Propellants in theater storage from nations other than the U.S. pose a more unknown hazard.

(1) The following is quoted from an ordnance officer returned from the Iraqi Theater in July 2003: **"Propellant is scattered all over the place in some of these areas. On one site they had bags of mortar propellant buried in berms that were 100 meters long."**

(2) The situation described above involving mortar propellant is among the *likeliest* of scenarios to result in an auto-ignition accident. A case in point is the auto-ignition accident that occurred at Hawthorne Army Depot in 1997. Thousands of bag charges of M9 propellant had been removed from old 81mm mortar rounds during a maintenance operation. The propellant was placed in barrier bags and overpacked into wooden boxes. Each box contained no more than 30 pounds of M9 propellant in the

bag charge configuration. A total of 20,000 pounds of propellant was in the storage magazine when the M9 mortar propellant *auto-ignited*. Temperatures inside the earth-covered magazine (ECM) prior to the fire would have been considered fairly high for an ECM, but would *not* have exceeded 90^0 F.

(3) If we compare the storage situation at Hawthorne with that of the mortar propellant that is piled in heaps in the Mesopotamian summer heat, we could say that such a situation is an accident waiting to happen. The likelihood of auto-ignition will grow with each passing day.

d. **Other Propellant Storage Situations** might lead to auto-ignition, but every situation must be evaluated on its merits. Examples of possible scenarios that you may experience in the field are evaluated in the following paragraphs.

(1) **155mm propelling charges in metal containers on pallets, stored outside in the direct sunlight. *Yes*,** this could lead to excessive deterioration of the propellant during the summer months. If the propellant is already twenty years old, then you are more likely to experience marked decomposition. Propelling charges that use *triple-base propellants* (M203-series charges) are *unlikely* to decompose to dangerous levels under *any* expected circumstances.

(2) **Boxes of small arms ammunition constantly exposed to sunlight and high heat conditions. *No***, not considered a problem regarding auto-ignition. The functional characteristics of the ammunition might suffer, but auto-ignition is *not* a realistic consideration.

(3**) Unpackaged mortar rounds in unsorted piles with propellant still assembled to the rounds. *No***, not considered a problem for auto-ignition as long as the propellant remains attached to the individual rounds.

(4) **Piles, drums, boxes, etc. of unsorted ammunition odds and ends such as bullets, artillery shells, cut propellant bags, all exposed to the elements. *Yes***, as it represents an unknown situation and therefore the groupings of “junk” ammunition MIGHT include sufficient quantities of propellant in a self-ignitable configuration to result in an auto-ignition accident. In the event of auto-ignition, this scenario is among the most dangerous because of the unknown and probably very dangerous mix of ammunition types.

e. **Propellant Stability.** Propellant does not become more sensitive to shock or friction due to long exposure to high heat/sunlight. Most artillery and small arms propellants are not particularly sensitive to shock or friction, though too much of either may be capable of igniting them. We are unaware of any studies that attribute markedly higher levels of shock and friction sensitivity to deteriorated/decomposed propellants.

f. **Transportation Precautions.** Special precautions should be taken when transporting propellants that are either known or suspected to be unstable. Normal

handling and shipping methods will not increase the danger of auto-ignition. That is to say, a can or box of propellant that is dropped three feet is no more likely to be ignited if the propellant is brand new or if it is deteriorated. However, if you are transporting unstable or potentially unstable propellant, the following is recommended as an **emergency field expedient**. If any of the three conditions described are noted, the propellant must be considered *imminently hazardous*. Propellant that exhibits any of the following characteristics may be capable of ***auto-igniting*** at **any time**.

(1) Check propellant for an acrid odor. Stable propellant will have a normal ether odor, while propellant that is or is nearing instability will have a strong, unpleasant acrid or urea odor. However, many types of ES stabilized propellant may have the characteristic urea odor of the stabilizer rather than an ether odor.

(2) Look for fumes when you open a propellant container. Unstable propellant will produce faintly visible brownish-red fumes under ambient conditions. If the propellant is exposed to the air, you will probably not be able to see the fumes, as they dissipate quickly. However, if you DO see fumes, the propellant is becoming unstable.

(3) Feel the container first and, if necessary, feel the propellant for increase in temperature. If the ambient temperature inside the container is already in the low to mid 100's ^{0}F, the propellant must generate a *LOT* of heat for you to tell the difference. If you can determine that the propellant is self-heating, it is unstable.

Remember:

NOTE: Once propellant reaches a state of instability that is physically manifested by any of the above conditions the time to auto-ignition can be very short. Take the greatest of care with such propellants. Whenever possible it is recommended that such propellants be intentionally burned in place.

7-5. Tips for Propellant Safety in Theater of Operations

a. There are many potentially hazardous scenarios for propellant auto-ignition in a theater of operations, especially if the theater has a hot climate such as where U.S. troops now operate in the Middle East. The higher the heat and the more sustained it becomes, the faster and greater the damage to exposed propellants.

b. U.S. Army propellants are constantly monitored and tested for stability levels. Even under extreme ambient conditions, any of your propellants should remain safe and stable for at least many months, and more than likely will remain safe for many years.

c. U.S. military-issue fixed rounds that are loaded with propellant range in size from small arms up to and including tank ammunition. Propellants in fixed rounds do *not* constitute an auto-ignition hazard.

d. Captured enemy ammunition that contains propellant presents an unknown risk. If item-specific guidance is not available you must, at a minimum, follow the safe storage and handling rules for U.S. propellants.

e. ANY propellants that are stored in bulk or are loaded into large caliber separate loading propelling charges (such as 155mm) present a potential for auto-ignition and must be cared for appropriately. Keep them out of the sun as much as possible and store them away from high explosives.

f. You know that YOUR propellants were safe and stable when they entered the theater of operations. You have NO IDEA of the stability potential of captured enemy ammunition.

APPENDIX A ABBREVIATIONS/ACRONYMS

AAP ..... Army Ammunition Plant
AAT ..... Accelerated Aging Test
ADC ..... Ammunition Data Card
AHA ..... Ammunition Holding Area
AIN ..... Ammunition Information Notice
AMC ..... Army Materiel Command
APE ..... Ammunition Peculiar Equipment
ARDEC ..... Army Research, Development and Engineering Center
ASP ..... Ammunition Supply Point
ASIS ..... Ammunition Surveillance Information System
BLAHA ..... Basic Load Ammunition Holding Area
BOE ..... Bureau of Explosives
CC ..... Condition Code
CFR ..... Code of Federal Regulations
DAC ..... Defense Ammunition Center
DOD ..... Department of Defense
DDA ..... Designated Disposition Authority
DPA ..... Diphenylamine
DODAC ..... Department of Defense Ammunition Code
DODIC ..... Department of Defense Identification Code
DSR ..... Depot Surveillance Record
ECM ..... Earth-Covered Magazine
EOD ..... Explosives Ordnance Disposal
EPCRA ..... Emergency Planning and Community Right to Know Act
FSC ..... Federal Supply Class
HPLC ..... High Performance Liquid Chromatography
HQ ..... Headquarters
IHDIV ..... Indian Head Division
IMSD ..... Inventory Management and Systems Division
IMR ..... Improved Military Rifle, “IMR” brand
JMC ..... Joint Munitions Command
JOCQAS ..... Joint Ordnance Commander's Quality Assurance Subgroup
LAP ..... Load, Assemble and Pack
LC ..... Liquid Chromatography
LRTAO ..... Logistics Review and Technical Assistance Office
MACS ..... Munitions Analytical Compliance System
MAERU ..... Mobile Ammunition Evaluation and Reconditioning Unit
MIDAS ..... Munitions Items Disposition Action System
MILVAN ..... Military-owned Demountable Container
MIN RES ..... Minimum Remaining Effective Stabilizer
MHP ..... Munitions History Program
MP ..... Multi-Perforated
MPP ..... Master Propellant Program
MMR ..... Military Munitions Rule

MRIP ..... Munitions Rule Implementation Policy
MRO ..... Materiel Release Order
NAR ..... Notice of Ammunition Reclassification
NATO ..... North Atlantic Treaty Organization
NICP ..... National Inventory Control Point
NIR ..... Near Infrared
NOC ..... Naval Ordnance Center
NSN ..... National Stock Number
NSWC ..... Naval Surface Warfare Center
OB/OD ..... Open Burn/Open Detonation
OCONUS ..... Outside Continental United States
PEP ..... Propellant, Explosives and Pyrotechnic
POP ..... Performance Oriented Packaging
PSP ..... Propellant Stability Program
PSSB ..... Propellant Safety Surveillance Board
QASAS ..... Quality Assurance Specialist (Ammunition Surveillance)
R3 ..... Resource Recovery and Recycling
RDT&E ..... Research, Development, Test and Evaluation
RES ..... Remaining Effective Stabilizer
SAAS ..... Standard Army Ammunition System
SB ..... Supply Bulletin
SC ..... Stability Category
SDS ..... Standard Depot System
SIP ..... Safe Interval Prediction
SLTP ..... Stockpile Laboratory Test Program
SMCA ..... Single Manager for Conventional Ammunition
SP ..... Single-Perforated
SPI ..... Special Packaging Instruction
SPP ..... Stockpile Propellant Program
TB ..... Technical Bulletin
TRI ..... Toxics Release Inventory
UNO ..... United Nations Organization
WMM ..... Waste Military Munitions

APPENDIX B SUMMARY OF ESSENTIAL INFORMATION

1. SPECIAL WARNINGS

a. Due to its inherent potential to become unstable and auto-ignite, PROPELLANT remains a very dangerous commodity in storage.

b. *Always* be certain of the safe, stable storage status for propellant types **M10** and **IMR.**

c. Maintain documented stability levels for ALL propellants (except Navy-owned and managed), ESPECIALLY those which belong to 11-series and third party account holders.

d. Navy propellant is monitored for stability, but uses a different reporting system from that of the Army.

e. Look for unreported containers of bulk propellant or propelling charges during Magazine Inspections, especially when dealing with RDT&E, "Special Purpose," and third-party assets.

f. *Always* confirm current stability level prior to the release of any propellant or propelling charge.

2. LOT IDENTITY

a. Maintain lot identity for ALL propellant stocks physically located on your installation, regardless of owner.

b. Request disposal directions for lots **"UNKNOWN"** and **"NONE."** These lots are potentially hazardous, their stability cannot be determined, and there are no requirements for such lots.

c. **"LOT MIXED"** is a prohibited lot identifier for propellant or propelling charges. Mixing propellant lots is potentially dangerous and is not allowed.

d. Lot numbers are prone to transcription errors; information on ADCs are occasionally incorrect. If you discover a lot for which you cannot find stability information, check to be sure that the lot number has been correctly recorded; the container or charge bag is usually marked with the *correct* lot number.

3. PROPELLANT DATABASE

a. Use the Propellant Database at least once per year to check all your propellant and propelling charge assets for proper stability identification.

b. Check all newly received propellant lots against the Propellant Database for proper stability identification.

c. Assure that the current “MIN RES” level is annotated at least once on the DSR.

d. Maintain sufficient documentation to verify that all required stability reviews have been accomplished.

4. REASSESSMENT/LOADING AUTHORIZATION

a. Remember to differentiate between stability and reassessment testing. Stability Category “A” propellant can still be in Condition Code “D” because it has an expired loading authorization.

b. Place into Condition Code “D” those serviceable bulk propellants and component charges for which the Loading Authorization has expired.

c. If unserviceable for visual/physical reasons, place propellant and component charges into the appropriate unserviceable condition code REGARDLESS of loading authority date. If loading authority has expired and lot is in an unserviceable code, be sure that the proper defect code that indicates expired loading authorization is entered in your automated records, i.e. LMP, MHP, SAAS-MOD or equivalent.

d. When shipping bulk propellant or component charges, be sure to include the date of loading authority expiration on the DD Form 1348-1 along with the current stability category.

5. RETAINING/DISPOSING OF EXCESS & CONDEMNED

a. Determine stability level of propellant to be generated prior to commencement of operation.

b. **ASSURE DESTRUCTION** of generated propellant as quickly as possible, but within 60 days, if stability is unknown.

c. Maintain lot identity for propellant that is generated from fixed rounds, or from any other source.

APPENDIX C PROPELLANT ITEMS IN THE SPP

The following list (arranged by ascending NSN) is a copy of the JMC listing that was current at time of publication. It contains identification of most of the bulk propellants, separate loading propelling charges, component charges, and incidental propellant-bearing components that may be in the SMCA inventory. Each line item listed below is, or may be, subject to the rules and direction of the Stockpile Propellant Program.
For the most up-to-date listing of propellant items, access the list on the JMC website at https://jmcsp.osc.army.mil/sites/mlrc/qa/qas/qasurveillance/default.aspx.

PROPELLANT ITEMS IN THE STOCKPILE PROPELLANT PROGRAM

NSN	DODIC	NOMENCLATURE
1145001038071	DX23	CHARGE, PROPELLING, 155MM
1145001406685	DX28	CHARGE, PROPELLING, 155MM
1145001406779	DX29	CHARGE, PROPELLING, 155MM
1310000284981	B622	CHARGE, PROP. INCR , M3A1 BAG (M8PROP) F/60MM
1310008265395	BX14	CHARGE, PROPELLANT INCR (M8 PROP) M182F/60MM
1310008372906		PROPELLANT INCREMENT FOR 40MM AP-T,M81 M81A1,AND M25
1310008546648	BX08	CHARGE, PROP INCR M181 F/60MM M302E1
1310010508896	ZZDT	CHARGE, PROPELLING, **M10** PROP F/60MM M204
1310015667489		CHARGE PROPELLING M236 FOR M1046 AND M1061 60MM MAPAM MORTAR CARTRIDGE
1310015683208		CHARGE, PROPELLING, M235
1315000284982	C240	CHG, PROP INCR, M1A1 FULL(BAG 6) F/81MM M1 & M29
1315000284983	C239	CHG, PROP INCR, M2A1 FULL (BAG 4) F/81MM M301A2
1315000285009	C709	CHARGE, PROPELLING, 4.2 INCH 25.5 RINGS/ CHARGE (M6)
1315000384983	C239	CHARGE, PROPELLANT INCREMENT, M2A1 & HOLDER, M3
1315001269035		PROPELLANT POWDER, M6 F/90MM CTG, M82
1315001284952	C241	PROPELLANT INCREMENT, M5 F/81MM
1315001410237	C773	CHG, PROP, 120MM, M45, FULL NFL (BAGGED 6) F/GUN M58
1315001529912	C437	CHARGE, PROPELLING, 105MM M121 (XM121) ZONED
1315002202362	CX50	CHARGE, PROPELLENT M90 WITH CHARGE A B FOR
1315003517910	ZARG	HALF INCR,M8 PROP F/PROP CHG M36/M36A1 F/4.2 INCH
1315003517911		FIVE INCR BUNDLE F/PROP CHG M36/36A1A1 F/4.2 INCH
1315003517912		INCREMENT, SINGLE F/CHG, PROP. M36/36A1 F/4.2 INCH
1315003517914	CX30	BAG LOADING ASSY 5 INCR. BAG F/CHG PROP M36 F/4.2 INCH
1315003703548	C021	INCREMENT A, M9 PROP, F/ CHG PROP M90A1 F/81MM
1315003789841	C022	INCREMENT B, M9 PROP, F/ CHG PROP M90A1 F/81MM
1315004250725	C020	CHARGE, PROPELLING, M185, M9 PROP F/81MM
1315004256040	C873	CHARGE, PROPELLING, M36A1, M8 PROP, F/4.2 IN
1315004313444	C872	CHARGE, PROPELLING, M82 NFL F/90MM CTG
1315004345508	C279	CHARGE, PROPELLING, M90A1 FULL F/81MM
1315008216665	CX69	HALF INCR F/PROP CHG, M36/M36A1 F/4.2 INCH
1315008216685	CX30	BAG LOADING ASSY. M9 PROP F/CHG PROP M36A1
1315008251384	C436	CHARGE, PROPELLING,M67, WHITE BAG F/105MM

NSN	DODIC	NOMENCLATURE
1315008251401	C434	CHARGE, PROPELLING,M1, FULL, WHITE BAG F/105MM
1315008265393	CX02	PROP FIVE INCR BUNDLE F/PROP CHG M36/ M36A1 F/4.2 INCH
1315008265401		INCREMENT, M1A1, M8 PROP F/81MM
1315008265404	C239	CHG PROP ,M2A2 FULL M2A1 INCR F/81MM
1315008265422		M8 PROPELLANT F/ CHG PROPELLING M36 AND M36A1
1315008287444	C873	CHG, PROP, M36A1, M8 PROP F/4.2 IN
1315008287465	C435	CHARGE, PROPELLING, M6 WHITE BAG F/105MM
1315008373246		CHARGE, PROPELLING F/75MM
1315008546645	C019	CHARGE, PROPELLING, M5,M9 PROP F/81MM
1315008546646	CX47	CHARGE, PROPELLING,M9 PROP F/81MM, M90 INCREMENT
1315008831472	CX46	CHARGE, PROPELLING, M90, INCR A F/81MM
1315009650841	C239	CHARGE, PROPELLANT,M2A1 INCR, M8 PROP F/81MM
131500D005278		PROPELLANT, M8, FRONT ASSEMBLY
131500D008438		CHARGE, PROPELLING,105MM, PXR200
131500D008589		BASE CHARGE ASSY, JA-2 PROP., 19 & 7 PERFORATION
131500D008693		CHARGE, PROPELLING M230 F/120MM MORTAR
131500D008733		CHARGE, PROPELLING F/120MM M57 WHITE BAG
131500D008734		CHARGE, PROPELLING F/120MM M57 BLUE BAG
131500D009891		CHARGE, PROPELLING, MODIFIED M230
1315010300442		PROPELLANT GRAIN, M5 FLAKE SP F/90MM
1315010508882	C043	CHARGE, PROPELLING M205, **M10** PROP F/81MM
1315010508906		BAG LDNG ASSY, M9 PROP F/ PROPCHG M36A2 F/4.2 IN
1315010555519		CHARGE, PROPELLING F/90MM CTG M590
1315010558590	C716	CHARGE,PROPELLING, 4.2 INCH
1315010662790	C427	CHARGE, PROPELLING, M1 PROP, BAGGED,FULL, F/105MM
1315011228591		CHARGE, PROPELLING, M1 PROP F/105MM
1315012237299		CHARGE, PROPELLING F/120MM M830/831
1315012332316		CHARGE, PROPELLING, M30 PROP F/105MM
1315012379775	C436	CHARGE, PROPELLING, M67 F/105MM
1315012901597		CHARGE, PROPELLING, M219 F/CTG 81MM
1315012901598		CHARGE, PROPELLING, M218 FOR CARTRIDGE, 81MM, SMOKE, M819
1315013292575	C044	CHARGE, PROPELLING, M220 FOR CARTRIDGE, 81MM, PRACTICE, M879
1315013367185	C436	CHARGE, PROPELLING, M67 IN NEW FIBER CONTAINER
1315013378940	C436	CHARGE, PROPELLING, M67 IN NEW STEEL CONTAINER
1315013636509		CHARGE PROPELLING, W/REDUCER F/105MM CANNON
1315014139822	C436	CHARGE, PROPELLING, M67 F/105MM
1315014921609		CHARGE, PROPELLING, 120MM, M234 PACKAGED IN FIBERBOARD BOX
1320000069654	D479	CHARGE, PROPELLING, M189 W/PRIMER F/152MM
1320000090351	D274	CHARGE, PROPELLING, 5 INCH 38 FULL FLASHLESS
1320000090352	D370	CHARGE, PROPELLING, 6 INCH 47 FULL FLASHLESS
1320000095316	D018	CHARGE ASSEMBLY, EXPULSION, **M10** PROP F/155MM
1320000142451	D661	CHARGE, PROPELLING, XM188E3 F/ 8 IN 55 CAL
1320000284369	D480	CHARGE, PROPELLING, M19 W/O PRIMER F/155MM
1320000284371	D480	CHARGE, PROPELLING, M19 W/PRIMER F/155MM
1320000284374	D675	CHARGE, PROPELLING, 8 INCH M1

NSN	DODIC	NOMENCLATURE
1320000284375	D676	CHARGE, PROPELLING, 8 INCH M2
1320000284378	D676	CHARGE, PROPELLING, 8 INCH M2, 2 INCR W/PRIM F/HOW
1320000284381	D715	CHARGE, PROPELLING, M43 W/PRIMER F/280MM
1320000284873	D540	CHARGE, PROPELLING, M3 W/PRIMER F/155MM
1320000284876	D540	CHARGE, PROPELLING, M3 W/O PRIMER F/155MM
1320000284877	D541	CHARGE, PROPELLING, M4 F/155MM
1320000284878	D541	CHARGE, PROPELLING, M4A1 WB W/O PRIMER F/155MM
1320000284879	D541	CHARGE, PROPELLING, M4A1 W/PRIMER F/155MM
1320000391971	D272	CHARGE, PROPELLING, 5 INCH 38 FULL NON FLASHLESS
1320000392037	D274	CHARGE, PROPELLING, 5 INCH 38 FULL WITH CASE
1320000392058	D282	CHARGE, PROPELLING, 5 INCH 38 REDUCED
1320000393336	D309	CHARGE, PROPELLING, 5 INCH 54 FULL NONFLASHLESS
1320000393351		CHARGE, PROPELLING, 5 INCH 54 FULL FLASHLESS
1320000393351	D310	CHARGE, PROPELLING, 5 INCH 54 FULL FLASHLESS
1320000393521	D368	CHARGE,PROPELLING,CLEARING, 6 INCH 47
1320000393528	D378	CHARGE, PROPELLING, 6 INCH 47 REDUCED, BRASS CASE
1320000393529	D376	CHARGE, PROPELLING, 6 INCH 47 FULL FLASHLESS
1320000393530	D377	CHARGE, PROPELLING, 6 INCH 47 REDUCED NONFLASHLES
1320000393532	D371	CHARGE, PROPELLING, 6 INCH 47 REDUCED NONFLASHLESS
1320000393533	D372	CHARGE, PROPELLING, 6 INCH 47 REDUCED FLASHLESS
1320000393538	D375	CHARGE, PROPELLING, 6 INCH 47 CALIBER FULL
1320000393538	D375	CHARGE, PROPELLING, 6 INCH 47 CALIBER FULL, BRASS CASE
1320000393539	D376	CHARGE, PROPELLING, 6 INCH 47
1320000393543	D369	CHARGE, PROPELLING, 6 INCH 47 CALIBER FULL
1320000393544	D370	CHARGE, PROPELLING, 6 INCH 47 FULL BRASS CASE
1320000704485	D662	CHARGE, PROPELLING, M188A1 WHITE BAG F/8 IN
1320001034930	D274	CHARGE, PROPELLING, 5 INCH 38 FULL WITH CASE
1320001068549	D362	CHARGE, PROPELLING, XM199 F/175MM
1320001138006	D676	CHARGE, PROPELLING,M2, WB, W/O PRIMER F/8 IN
1320001436847	D533	CHARGE, PROPELLING, 155MM WHITE BAG M119
1320001737356	D369	CHARGE, PROPELLING, 6 INCH 47 CALIBER FULL
1320001737357	D370	CHARGE, PROPELLING, 6 INCH 47 FULL STEEL CASE
1320001748174	D274	CHARGE, PROPELLING, 5 INCH 38 FULL WITH CASE
1320001823030	D361	CHARGE, PROPELLING, M86A2 W/PRIMER F/175MM
1320002034043	D203	CARTRIDGE, 5 INCH 25 SHORT FLASHL
1320003085539	D676	CHARGE, PROPELLING, M2 F/8 IN
1320003085555	D676	CHARGE, PROPELLING, M2 F/8 IN
1320003132461	D296	CHARGE, PROPELLING, CLEARING 5 INCH 38 AND 54 CAL
1320004055135	D368	CHARGE,PROPELLING,CLEARING, 6 INCH 47
1320004118606	D264	CHARGE, PROPELLING, 5 INCH 38 FULL
1320004118607	D326	CHARGE, PROPELLING, 5 INCH 54 FULL
1320004514907	D536	CHARGE, PROPELLING, M124, M6 PROP, F/175MM
1320004572577	D272	CHARGE, PROPELLING, 5 INCH 38 CALIBER, FULL, WITH CASE, MK 10 MOD 0 OR 1
1320004999208	D326	CHARGE, PROPELLING, 5 INCH 54 EX 67 MOD 2
1320005420132	D675	CHARGE, PROPELLING, M1 W/PRIMER F/8 IN

NSN	DODIC	NOMENCLATURE
1320005570928	D272	CHARGE, PROPELLING, 5 INCH 38 FULL WITH CASE
1320005570931	D272	CHARGE, PROPELLING, 5 INCH 38 FULL WITH CASE
1320006287741	D674	CHARGE, PROPELLING M80 F/8 IN
1320007665824	D297	CHARGE, PROPELLING, 5 INCH 54 REDUCED
1320007679441	D534	CHARGE, PROPELLING, XM119 W/PRIMER F/155MM
1320007751533	D536	CHARGE, PROPELLING, M124 W/PRIMER F/175MM
1320007837980	D017	CHARGE ASSEMBLY, EXPULSION, **M10** PROP F/8 IN
1320008713723	D264	CHARGE, PROPELLING, 5 INCH 38 FULL WITH CASE
1320008713723	D264	CHARGE, PROPELLING, 5 INCH 38 FULL WITH CASE
1320008793925	D324	CHARGE, PROPELLING, 5 INCH 54 FULL
1320008924201	D361	CHARGE, PROPELLING, M86 W/PRIMER F/175MM
1320009263986	D361	CHARGE, PROPELLING, M86A2 W/PRIMER F/175MM
1320009351922	D540	CHARGE, PROPELLING, M3A1 W/O PRIMER F/155MM
1320009351923	D541	CHARGE, PROPELLING, M4A2 W/O PRIMER F/155MM
1320009958022	D537	CHARGE, PROPELLING, XM115 F/155MM
132000D002569		CHARGE, PROPELLING, XM224 MOD REAR F/155MM
132000D002570		CHARGE, PROPELLING, ,XM224 MOD FWD F/155MM
132000D007858		CHARGE ASSEMBLY, EXPULSION, **M10** PROP
132000D007858		EXPULSION CHARGE ASSEMBLY
132000D009441		EXPULSION CHARGE ASSEMBLY F/XM982
132000D009876		CHARGE, PROPELLING, L6A1 W/O PRIMER F/155MM
132000D010012		CHARGE, PROPELLING, XM232 W/XM231 CASE
132000D010051		PROPELLANT GRAIN, AFT F/XM982
132000D010063		EXPULSION CHARGE ASSEMBLY
132000X110326		CHARGE, PROPELLING, M203E2 F/155MM
132000X110355		CHARGE, PROPELLING, XM216A F/155MM
132000X110359		CHARGE, PROPELLING, XM216B F/155MM
132000X110609		CHARGE, PROPELLING, XM224 BASE INC.F/ 155MM
132000X110610		CHARGE, PROPELLING, XM224 FWD INC F/155MM
132000X110718		CHARGE, PROPELLING, FH70, CHG 7 F/155MM
1320010041082	D326	CHARGE, PROPELLING, 5 INCH 54 CALIBER, MK 67 MOD 3
1320010142451	D661	CHARGE, PROPELLING, M188E3 FULL F/ 8 IN 55 CAL
1320010156243	D010	CHARGE ASSEMBLY, EXPULSION F/8 INCH PROJ XM172
1320010208938	D532	CHARGE, PROPELLING,M203 SERIES RB F/155MM
1320010339394	D532	CHARGE, PROPELLING, M203 W/O PRIMER F/155MM
1320010419890	D531	CHARGE, PROPELLING, XM201E5 F/155MM
1320010514132	D533	CHARGE, PROPELLING, 155MM M119A1
1320010521317	ZZKO	CHARGE ASSEMBLY, EXPULSION, **M10** PROP, F/155MM
1320010545107		PROPELLANT GRAIN F/155MM RAP M549
1320010562826	D296	CHARGE, PROPELLING, 5 INCH 38/54 CALIBER CLEARING, MK 65 MOD 1
1320010578440		PROPELLANT GRAIN, F/155MM M549
1320010601118	D297	CHARGE, PROPELLING, 5 INCH 54
1320010642746	D326	CHARGE, PROPELLING, 5-INCH 54 CALIBER FULL, EX 67 MOD 4
1320010704485	D662	CHARGE, PROPELLING, M188A1 WB W/O PRIMER F/ 8 IN
1320010704486	D662	CHARGE, PROPELLING, M188A1 WB W/O PRIMER F/8 IN

NSN	DODIC	NOMENCLATURE
1320010771312		PROP GRAIN, XM650E5 F/HERA 8 IN M650 (1320-D624)
1320010936856	D533	CHARGE, PROPELLING, 155MM M119A2
1320011121624	D032	CHARGE ASSY, EXPULSION, **M10** PROP F/155MM
1320011493515	D326	CHARGE, PROPELLING, 5 INCH 54
1320011525613		CHARGE, PROPELLING WB F/155MM
1320011555699	D297	CHARGE, PROPELLING, 5 INCH 54
1320011560020	D324	CHARGE, PROPELLING, 5 INCH 54
1320011572494	D282	CHARGE, PROPELLING, 5 INCH 38
1320011643486	D030	CHARGE ASSY, EXPULSION, **M10** PROP F/155MM PROJ.
1320011865653		PROP GRAIN F/FWD RKT MTR F/155MM M549A1 2CLASS
1320011866564		PROP GRAIN F/AFT RKT MTR F/155MM M549A1 2CLASS
1320011877651		PROP GRAIN F/FWD RKT MTR F/155MM M549A1 1CLASS
1320011877652		PROP GRAIN F/AFT RKT MTR F/155MM A549A1 1 CLASS
1320012023989	D532	CHARGE, PROPELLING,M203 SERIES, RB F/155MM
1320012028938	D532	CHARGE, PROPELLING, M203A1 F/155MM
1320012139660	D345	CHARGE, PROPELLING, 5 INCH 54
1320012317231	D662	CHARGE, PROPELLING, M188A1 WB W/O PRIMER F/8 IN
1320012850134	D471	CHARGE, PROPELLING, XM216 F/155MM
1320012853066	D470	CHARGE, PROPELLING, XM215 F/155 MM
1320012856415	D472	CHARGE, PROPELLING, XM 216, INCR B F/155MM
1320013073952	D540	CHARGE, PROPELLING, M3A1 GB W/O PRIMER F/8 IN
1320013073953	D541	CHARGE, PROPELLING, M4A2 WB W/O PRIMER F/155MM
1320013104857	D533	CHARGE, PROPELLING, M119A2 F/15MM
1320013129058	D533	CHARGE, PROPELLING, M119A2, PACKAGED IN A PA131 CONTAINER
1320013129059	D540	CHARGE, PROPELLING, M3A1 GB W/O PRIMER F/155MM
1320013172382		CHARGE, PROPELLING, M4A2 W/O PRIMER F/155MM
1320013200966		CHARGE ASSEMBLY, EXPULSION, **M10** PROP F/155MM
1320013349448		CHARGE ASSEMBLY, EXPULSION, **M10** PROP F/155MM
1320014544603	DA12	CHARGE, PROPELLING, 155 MILLIMETER M231
1320014574063	DA13	CHARGE, PROPELLING, 155 MILLIMETER M232
1320015266523	DA13	CHARGE, PROPELLING, 155 MILLIMETER M232A1
1320014639092	DWDC	CHARGE, PROPELLING, 5 INCH 62 CALIBER, MK 167 MOD 0
1320011693221	D846	CHARGE, PROPELLING, 16 INCH 50 CALIBER
1320012304001	D846	CHARGE, PROPELLING, 16 INCH 50 CALIBER
1320013233623	D846	CHARGE, PROPELLING, 16 INCH 50 CALIBER
1320000899784	D845	CHARGE, PROPELLING, 16 INCH 50 CALIBER, REDUCED, FLASHLESS
1320012638049	D845	CHARGE, PROPELLING, 16 INCH 50 CALIBER
1320000899785	D840	CHARGE, PROPELLING, 16 INCH 50 CALIBER, REDUCED, NONFLASHLESS
1320012638050	D840	CHARGE, PROPELLING, 16 INCH 50 CALIBER
1320000394076	D839	CHARGE, PROPELLING, 16 INCH 50 CALIBER, FULL, NONFLASHLESS
1320011252562	D839	CHARGE, PROPELLING, 16 INCH 50 CALIBER, FULL BAGGED, NON-FLASHLESS
1320011391758	D839	CHARGE, PROPELLING, 16 INCH 50 CALIBER, FULL BAGGED, NON-FLASHLESS
1320000284376	D676	CHARGE, PROPELLING, 8 INCH M2
1320000284377	D676	CHARGE, PROPELLING, 8 INCH M2

NSN	DODIC	NOMENCLATURE
1320003083366	D675	CHARGE, PROPELLING, 8 INCH M1
1320003083909	D675	CHARGE, PROPELLING, 8 INCH M1
1320003085523	D675	CHARGE, PROPELLING, 8 INCH M1
1320001857212	D661	CHARGE, PROPELLING, M188
1320000393810	D617	CHARGE, PROPELLING, 8 INCH 55 CALIBER, CLEARING, BRASS CASE MK 2 MOD 0, PRIMER MK 35 MOD 1, PLASTIC PLUG M K 1 MOD 0, FLASHLESS, FOR RF GUN
1320004366338	D617	CHARGE, PROPELLING, 8 INCH 55 CALIBER, CLEARING, BRASS CASE MK 2 MOD 0, PRIMER MK 35 MOD 1, PLASTIC PLUG M K 1 MOD 0, FLASHLESS, FOR RF GUN
1320000393809	D616	CHARGE, PROPELLING, 8 INCH 55 REDUCED FLASHLESS 0
1320001316761	D615	CHARGE, PROPELLING, 8 INCH 55 REDUCED NONFLASHLESS
1320008716761	D611	CHARGE, PROPELLING, 8 INCH 55
1320008907916	D611	CHARGE, PROPELLING, 8 INCH 55 CALIBER FULL, BRASS CASE
1320008713724	D610	CHARGE, PROPELLING, 8 INCH 55 FULLL UNIVERSAL ONE
1320000894276	D609	CHARGE, PROPELLING, 8 INCH 55 CALIBER FULL, FLASHLESS NUMBER 1
1320000393808	D608	CHARGE, PROPELLING, 8 INCH 55 CALIBER FULL, BAGGED, FLASHLESS NUMBER 2 HALF
1320000393814	D607	CHARGE PROPELLING, 8 INCH 55 CALIBER, FULL BAGGED, NON-FLASHLESS NUMBER 2 HALF
1320000393811	D606	CHARGE, PROPELLING, 8 INCH 55 REDUCED BRA
1320008165516	D606	CHARGE, PROPELLING, 8 INCH 55 CALIBER REDUCED, BRASS CASE
1320000894275	D605	CHARGE, PROPELLING, 8 INCH 55 FULL NONFLASHLESS N
1320000393789	D603	CHARGE, PROPELLING, 8 INCH 55 CALIBER REDUCED, BRASS CASE
1320008165517	D603	CHARGE, PROPELLING, 8 INCH 55 CALIBER REDUCED, BRASS CASE
1320000393801	D602	CHARGE, PROPELLING, 8 INCH 55 CALIBER FULL, BRASS CASE MK 1 ALL MODS, PRIMER MK37 ALL MODS, PLASTIC PLUG MK1 MOD 0, FLASHLESS FOR RF GUN
1320008299767	D602	CHARGE PROPELLING, 8 INCH 55 CALIBER FULL, BRASS CASE
1320000393790	D601	CHARGE,PROPELLING, 8 INCH 55 CALIBER FULL, BRASS CASE MK 1 ALL MODS, PRIMER MK37 ALL MODS, PLASTIC PLUG MK1 MOD 0, NONFLASHLESS FOR RF GUN
1320008299766	D601	CHARGE,PROPELLING, 8 INCH 55 CALIBER FULL, BRASS CASE MK 1 ALL MODS, PRIMER MK37 ALL MODS, PLASTIC PLUG MK1 MOD 0, NONFLASHLESS FOR RF GUN
1320001030836	D600	CHARGE, PROPELLING, 8 INCH 55 REDUCED NONFLASHLESS
1320000393350	D306	CHARGE, PROPELLING, 5 INCH 38 CALIBER, CLEARING, BRASS CASE MK 6 MOD 0, PRIMER MK 13 MOD 0,1 OR 2 FLASHLESS
1320000393353	D305	CHARGE, PROPELLING, 5 INCH 54 FULL FLASHLESS
1320011493514	D305	CHARGE, PROPELLING, 5 INCH 54
1320011493513	D304	CHARGE, PROPELLING, 5 INCH 54
1320010284944	D304	CHARGE, PROPELLING, 5 INCH 54 CALIBER FULL, MK73 MOD 0
1320011701429	D304	CHARGE, PROPELLING, 5 INCH 54

NSN	DODIC	NOMENCLATURE
1356011065985	WW98	PROPELLANT, INIT MK 48
1376011775974		PROPELLANT, F/120MM M830/M831
1376000069652		PROPELLANT POWDER, M6 F/ 75MM
1376000069653		PROPELLANT POWDER, M6 F/105MM
1376000090041		PROPELLANT POWDER, M1,SP F/105MM, M67 PROP CHG
1376000090042		PROPELLANT POWDER, M1,MP F/105MM, M67 PROP CHG
1376000090043		PROPELLANT POWDER, **M10**,SP F/57MM WEB 0,025
1376000090044		PROPELLANT POWDER, **M10**,SP F/57MM
1376000090045		PROPELLANT POWDER, M30E1 F/155M PROP CHG XM123
1376000090046		PROPELLANT POWDER, M30A1, MP F/ 8 IN PROP CHG
1376000539367		PROPELLANT POWDER, M30 F/ 90MM CARTRIDGE M431
1376000539371		PROPELLANT POWDER, M30 F/105MM M728E1
1376000685086		PROPELLANT POWDER, M30,MP F/105MM M392A2
1376000845010		BENITE POWDER, SMOKELESS
1376001269035		PROPELLANT POWDER, M6 F/CARTRIDGE 90MM
1376002798760		PROPELLANT POWDER, M6 F/90MM CARTRIDGE
1376004322101		PROPELLANT POWDER, M30 F/90MM CTG
1376004322191	XX10	PROPELLANT POWDER, M30 F/CTG 90MM M318/M353
1376004512881		PROPELLANT POWDER, M1 RECLMED F/155MMPROP CHG
1376004512882		PROPELLANT M2, MP, RECLAIMED F/165MM M123A1
1376004512883		PROP POWDER, M6,SP, RECLAIMED F/CTG 90MM
1376004514906		RECLAIMED PROPELLANT F/SMALL ARMS (**IMR**) (M1)
1376004514907		PROPELLANT POWDER, M6 F/175MM PROP CHG M12M4 GB
1376004769357		PROP POWDER,**M10** F/57MM, 75MM AND 105MM RECLAIMED
1376006539822		PROPELLANT, BALLISTITE, BULK, N-1 SHEETS
1376006539825		PROPELLANT, BALLISTITE, BULK, N-5 SHEETS
1376006942017		PROPELLANT POWDER F/PISTOL P4768
1376007721370	MY57	PROPELLANT, 1 POUND CAN **IMR** 4064 F/ CANINE KIT
1376008546659		PROPELLANT POWDER, M17, TYPE 2 F/90MM, M318A1
1376008546710	CX52	PROPELLANT POWDER, M26 F/CTG 106MM HEAT M344A1
1376008712829		PROPELLANT POWDER, M1,MP F/VARIOUS TYPES
1376008712889		PROPELLANT POWDER F/155MM M4A1
1376009373922		PROPELLANT POWDER, BENITE 9 IN. LENGTH
1376009373940		BENITE 10 IN. LENGTH F/PRIMER, M83
1376009373978		PROPELLANT POWDER BENITE STRANDS 11.437 IN LENGTH
1376009373995		BENITE 17.437 INCH STRANDS
1376009796091		POWDER, SMOKELESS, STARTER, GRANULATION NO. 2
1376009796092		POWDER, SMOKELESS, STARTER, GRANULATION NO. 3
1376009876802	VX76	PROPELLANT, GRAIN ELECTRIC POWER UNITGREEN,FOR HAWK
1376010300442		PROPELLANT, M5, SP,FLAKE, F/90MM CHG, M82
1376010489868		PROPELLANT POWDER, **IMR** 5010, F/ CTG CAL .50 BALL M33
1376010491448	C558	PROPELLANT POWDER, WC 846 F/7.62MM TRACER M62

NSN	DODIC	NOMENCLATURE
1376010491449		PROPELLANT POWDER, WC846 F/7.62MM BALL M80
1376010491450		PROPELLANT POWDER, WC846 F/7.62MM MATCH M118
1376010491451		PROPELLANT POWDER, **IMR** 8028 F/5.56MM TR, M196
1376010491452		PROPELLANT POWDER, **IMR** 7383 F/50 CAL SP TR, M48A2
1376010491453		PROPELLANT POWDER, **IMR** 8097 F/7.62MM GRN RIFLE M64
1376010491454		PROPELLANT POWDER, **IMR** 5010 F/CTG, CAL 50 TR M17
1376010491455		PROPELLANT POWDER, **IMR** 4895 F/CTG, CAL 30 BALL, M2
1376010491456		PROPELLANT POWDER, **IMR** 4895 F/CTG, CAL 30 TR
1376010491457		PROPELLANT POWDER, **IMR** 4895 F/7.62MM MATCH, M118
1376010491458		PROPELLANT POWDER, HPC-4 F/7.62MM CTG GR RIFLE M64
1376010491459		PROPELLANT POWDER, HPC-8 F/7.62MM FRANG., M160
1376010491460		PROPELLANT POWDER, HPC-13 F/5.56MM BLANK, M200
1376010491461		PROPELLANT POWDER, SR4900 F/CTG CAL 30, BLNK M1909
1376010491462		PROPELLANT POWDER, SR 8231 F/CTG, 7.62MM BLNK, M82
1376010491463		PROPELLANT POWDER, CMR 100 F/CTG, CAL 30, BALL, M2
1376010491464		PROPELLANT POWDER, WC 820 F/CTG, CAL 30, BALL, M1
1376010491465		PROPELLANT POWDER, HPC-5 F/CTG, CAL 30, BALL, M1
1376010491466		PROPELLANT POWDER, HPC-2 F/7.62MM BLANK, M82
1376010491467		PROPELLANT POWDER, WC 818 F/7.62MM BLANK, M82
1376010491468		PROPELLANT POWDER, WC 852 F/CTG, CAL 30, BALL, M2
1376010491469		PROPELLANT POWDER, WC 870 F/CTG, 20MM
1376010507209		PROPELLANT POWDER, M26E1 F/152MM PROP CHG M189
1376010530362		PROPELLANT POWDER, M6 TYPE1 F/105MM CTG M494
1376010539358		PROPELLANT POWDER, M1
1376010539359		PROPELLANT POWDER, M30, TYPE 1 F/105MM CTG
1376010539360		PROPELLANT POWDER, M1, TYPE 1 F/105MM CTG
1376010539362		PROPELLANT POWDER, M6, MP, TYPE 1 F/105MM CTG
1376010539363		PROPELLANT POWDER, M9 FLAKE F/105MM CTG
1376010539364		PROPELLANT POWDER, M9, FORM A F/4.2 IN PROP CHG
1376010539365		PROPELLANT POWDER, M9, FLAKE F/81MM INCR.M185
1376010539366		PROPELLANT POWDER, M9, FORM A F/4.2 IN PROP CHG
1376010539367		PROPELLANT POWDER, MIXTURE M30 F/CTG, 90MM
1376010539368		PROPELLANT POWDER, M5 MIXTURE, FORM A
1376010539369		PROPELLANT POWDER, M26 F/CTG 106MM RIFLE
1376010539370		PROPELLANT POWDER, M6, MP F/175MM M86 SERIES
1376010539371		PROPELLANT POWDER, M30 F/ 105MM
1376010539372		PROPELLANT POWDER, M6,MP F/155MM M119 SERIES
1376010539373		PROPELLANT POWDER, M9, FORM A F/40MM CTG
1376010539373		PROPELLANT POWDER, SHEET 33 IN LENGTH
1376010541577		PROPELLANT POWDER, M1MP F/155MM M4A2 WB
1376010545157		PROPELLANT POWDER, CR8325 F/20MM CTG, M139
1376010545158		PROPELLANT POWDER, WC875 F/20MM CTG M99A1
1376010545171		PROPELLANT POWDER, **IMR**4475 F/7.62MM, M60, HPT
1376010550993		PROPELLANT POWDER, HPC F/CAL 38 CTG,BALL
1376010550995		PROPELLANT POWDER F/7.62MM GRENADE CTG, M64

NSN	DODIC	NOMENCLATURE
1376010550996		PROPELLANT POWDER F/CAL .30 M1909 BLANK
1376010550997		PROPELLANT POWDER, WC860 F/CAL 50 BALL M33/AP M2
1376010550998		PROPELLANT POWDER, WC844, F/5.56MM, M193 BALL
1376010550999		PROPELLANT POWDER, WC,F/7.62MM FRANGIBLE, M160
1376010551000		PROPELLANT POWDER, SR, F/7.62MM FRANGIBLE, M160
1376010551001		PROPELLANT POWDER, **IMR**, F/5.56MM HPT
1376010551551		PROPELLANT POWDER, M30A1, MP
1376010551555		PROPELLANT POWDER, M30A1,MP,F/105MM PROP CHG
1376010552772		PROPELLANT POWDER, WC844, F/5.56 BALL M196 TR
1376010552783		PROPELLANT POWDER, M6+2, MP F/GUN 76MM
1376010552784	ML73	PROPELLANT POWDER, NACO, 5/54 SPCF
1376010553436		PROPELLANT POWDER, M1 F/105MM M724A1
1376010553437		PROPELLANT POWDER, M30, MP, F/105MM M735, M392
1376010555971		PROPELLANT GRAIN, SHEET STOCK, 15 IN CARPET ROLLS
1376010558597		PROPELLANT POWDER, M1,SP F/8 INCH CHG, PROP M2
1376010558598		PROPELLANT POWDER, **M10** FLAKE F/155MM & 8IN
1376010558599		PROPELLANT POWDER, M30A2, MP F/8 IN PROP CHG, M188
1376010559903		PROPELLANT POWDER, MIXTURE M5
1376010559904		PROPELLANT POWDER, **M10** FLAKE F/81MM M205 INCR
1376010560768		PROPELLANT POWDER, M1 F/90MM M71
1376010562671		BENITE 14 IN. LENGTH F/PRIMER XM120
1376010581652		PROPELLANT POWDER, **IMR** F/CAL 30 TR/7.62MM M118
1376010581653		PROPELLANT POWDER (WC) F/CAL .30 TR M27 CARBINE
1376010585086		PROPELLANT POWDER, M30
1376010594572		PROPELLANT POWDER, M9 FLAKE F/81MM M90A1 A/B CHGS
1376010630140		PROPELLANT POWDER, M1, SP F/155MM M3A1
1376010647316		PROPELLANT POWDER, M6 PROP FORM C TYPE 1
1376010659849		PROPELLANT POWDER, M30, MP F/76MM CTG
1376010659850		PROPELLANT POWDER, M5 PROP F/90MM CTG M37E1/M371
1376010664179		PROPELLANT, M2, SINGLE PERFORATED
1376010664180		PROPELLANT POWDER, M30, MP F/105MM M735
1376010665003		PROPELLANT POWDER, **IMR** F/CAL .50 API-T, M20
1376010685086		PROPELLANT POWDER, M30, MP F/105MM M735
1376010685087		PROPELLANT POWDER, M1 COMP F/ 105MM M724E1
1376010737529		PROPELLANT POWDER, WC 872 F/CTG, 20MM
1376010762607		PROPELLANT POWDER, M30A1, SP F/105MM M85,M121
1376010784062		PROPELLANT POWDER, M6, MP F/76MM M496 HEAT
1376010788199		PROPELLANT POWDER, WC 680 F/7.62MM BALL
1376010822105		PROPELLANT POWDER, M9 FLAKE F/81MM INCR M90/90A1
1376010844229		PROPELLANT POWDER, M30A1, MP F/155MM M203
1376010851882		PROPELLANT POWDER, **M10** FLAKE F/60MM M204 INCR
1376010857243		PROPELLANT, M2, MULTI-PERFORATED
1376010862973		PROPELLANT POWDER, M31A1, MP F/8 IN PRPCHG M188E1A1
1376010990236		PROPELLANT POWDER, M9 F/60MM IGNITION CTGS
1376011075378		PROPELLANT, M9, FOR 81MM IGNITER CARTRIDGE

NSN	DODIC	NOMENCLATURE
1376011105580		PROPELLANT, M30A2
1376011200956	025G	PROPELLANT POWDER 3/50 SPCG F/NAVAL GUNS I TYPE
1376011200957		PROPELLANT POWDER F/PROP CHG F/CANNON
1376011204100		PROPELLANT POWDER, M31 PROP F/120MM PROP CHG M45
1376011204560		PROPELLANT POWDER, **IMR** 4903 F/20MM CTG
1376011225289		PROPELLANT POWDER F/VARIOUS SOLID PRP RKT GRAINS
1376011235089		PROPELLANT POWDER, M17 F/CARTRIDGE, 90MM, M353
1376011255945		PROPELLANT POWDER, M30 PROP F/105MM
1376011255946		PROPELLANT POWDER, M30 F/105MM HEAT-T M456A2
1376011263602		PROPELLANT POWDER, 5/38 SPCF
1376011265051		PROPELLANT POWDER, 3/50 SPCG
1376011268342		PROPELLANT POWDER, **M10** FLAKE
1376011270728		PROPELLANT POWDER F/NAVAL GUNS
1376011275190		PROPELLANT POWDER, SPD F/5 IN 35
1376011275191		PROPELLANT POWDER, SPD F/5 IN 54
1376011275192		PROPELLANT POWDER, SPD F/6 IN 47
1376011275193		PROPELLANT POWDER, SPD F/16 IN 45
1376011275194		PROPELLANT POWDER, SPD,PYROCELLULOSE F/16 IN 50
1376011279540		PROPELLANT POWDER, SPDB,PYROCELLULOSE F15 IN 38
1376011279541		PROPELLANT POWDER, SPDF F/ 5 IN 54.
1376011294679	025A	PROPELLANT POWDER, M6,SPDN F/3IN 50
1376011294680		PROPELLANT POWDER, M6,SPD F/ 5 IN 38
1376011294681		PROPELLANT POWDER, M6,SPDN F/16 IN 47 CAL
1376011294682		PROPELLANT POWDER, M1, SPDN F/20MM
1376011294683	015A	PROPELLANT POWDER, M1, SPDN F/40MM
1376011298053		PROPELLANT POWDER, SPD, PYROCELLULOSE F/4 IN 50
1376011298055		PROPELLANT POWDER, SPD, PYROCELLULOSE F/8 IN 55
1376011298059	043F	PROPELLANT POWDER F/ 5 INCH 38
1376011301974		PROPELLANT POWDER, M6 PROP SPDN F/8IN 55
1376011321692		PROPELLANT POWDER, WC814, F/5.56MM BLANK M200
1376011321711		PROPELLANT POWDER, 3/50 SPDF IHPB 103 FL
1376011321712		PROPELLANT POWDER, SPDF 5/38
1376011327304		PROPELLANT POWDER, SPDW F/ 5 IN 54
1376011329160		PROPELLANT POWDER, BS-NACO F/5 IN 54
1376011337463		PROPELLANT POWDER, **M10** FLAKE F/60MM INCR M204
1376011411060		PROPELLANT POWDER, **M10**,MP F/75MM, M309A1
1376011411230		PROPELLANT POWDER, M30,MP F/105MM M774
1376011420541		PROPELLANT, 8/55 SPCF RHDE 68775 FNA
1376011491702		PROPELLANT POWDER, M30,MP F/105MM APFSDS-T M833
1376011523078		PROPELLANT,SOLVENTLESS F/155MM RA M549A1 1CLASS
1376011523079		PROPELLANT,SOLVENTLESS F/155MM RA M549A1 2 CLASS
1376011643489		PROPELLANT, SHEET STOCK, NOSOL 318
1376011768765		PROPELLANT POWDER, M6+2 F/5 IN 54
1376011779229		PROPELLANT POWDER, JA-2, 15 IN STICK F/120MM XM 827
1376011779230		PROPELLANT POWDER, JA-2 F/120MM M829

NSN	DODIC	NOMENCLATURE
1376011779231		PROP POWDER, DIGL-RP, 14 IN STICK F/120MM XM 830/831
1376011779232		PROP POWDER, DIGL-RP, FORM B,4 IN STICK F/120MM
1376011779233		PROPELLANT, DIGL-RP, FLAKE SHAPE
1376011779234		PROPELLANT POWDER, LKL F/120MM CTG XM865
1376011795974		PROP POWDER, DIGL-RP FORM D F/120MMXM830/831
1376011795974		PROPELLANT POWDER, DIGL-RP F/120MM CTG XM830/831
1376011803513		PROPELLANT POWDER, WC844 F/5.56MM TR M856
1376011803514		PROPELLANT POWDER, WC844T F/5.56MM BALL M855
1376011841696		PROPELLANT POWDER, **IMR** 4895 F/CTG 7.62MM M852
1376011877650		PROPELLANT POWDER, M14 F/105MM M490A1
1376011901114		PROPELLANT POWDER
1376011901115		PROPELLANT POWDER F/40MM SGT YORK SYSTEM
1376011924164		PROPELLANT POWDER, WC844 F/5.56MM BALL M855
1376011959610		PROPELLANT, DOUBLE BASE, SPHERIODAL F/5.56MM CTG
1376012037484		PROPELLANT POWDER, SINGLE BASE F/CAL 45 BALL
1376012037489		PROPELLANT DOUBLE BASE WC844 F/5.56MM M855
1376012049784	MM07	PROPELLANT POWDER F/CAD/PAD
1376012049785	MM08	PROPELLANT POWDER F/CAD/PAD
1376012104040		PROPELLANT, DOUBLE BASE, WC858 F/20MM M54A1
1376012135669		PROP POWDER, M31A1, SP 29 IN SLOTTED STICK F/155MM
1376012189319		PROPELLANT, BULK SOLID M6
1376012215664		PROPELLANT GRAIN, HES-5250.207
1376012215665		PROPELLANT, HES5808.23
1376012215666		PROPELLANT GRAIN F/IMPULSE CTG CCU-52A
1376012215667		PROPELLANT, NOSOL-318 FOR CCU-52/A IMPULSE CARTRIDGE
1376012215745		PROPELLANT, M9
1376012230934		PROPELLANT GRAIN F/CTG. ACT. INIT. M53/91/99
1376012230935		PROPELLANT, TYPE 2400
1376012230936		PROPELLANT GRAIN F/CADS
1376012230937		PROPELLANT GRAIN F/CADS
1376012230938		PROPELLANT GRAIN F/IMPULSE CTG M119
1376012230939		PROPELLANT GRAIN F/IMPULSE CTG CCU-56A
1376012240356		PROPELLANT GRAIN, M2 PROP F/IMP CTG MK 40 MOD 0
1376012279360		PROPELLANT GRAIN, M2 PROP F/CTG M31A2
1376012477208		PROPELLANT POWDER, M6 MIXTURE FORM C TYPE1
1376012556279		PROPELLANT POWDER, M38 SPHERIODAL F/81MM PROP CHG
1376012625398		PROPELLANT POWDER, M8 PROP
1376012740751		PROPELLANT POWDER F/CAL 38 BALL/IMPULSE CTG M796
1376012791324		PROPELLANT GRAIN F/INITIATOR JAU-22B
1376012791325		PROPELLANT GRAIN F/CADS
1376012792452		PROPELLANT GRAIN F/INITIATOR JAU-22B
1376012792453		PROPELLANT GRAIN F/CADS
1376012811665		PROPELLANT GRAIN F/ROCKET MOTORS & FUZES
1376012830197		PROPELLANT POWDER F/ACRFT CANOPY REMOVER M151
1376012853107		PROPELLANT POWDER F/CTG IMPULSE 150

NSN	DODIC	NOMENCLATURE
1376012917040		PROPELLANT POWDER, WC859 F/20MM
1376012998859		PROPELLANT POWDER,BENITE STRANDS 30.2 IN LENGTH
1376013009526		PROPELLANT POWDER, WC440S F/CAL .50 BLANK
1376013061237		PROPELLANT GRAIN F/CADS MK 47
1376013061238		PROPELLANT GRAIN F/CADS
1376013159742		PROPELLANT POWDER, M43 F/105MM CTG M900 SERIES
1376013186315		PROPELLANT POWDER, BENITE STRANDS 8.25 IN LENGTH
1376013253586		PROPELLANT GRAIN, HPC-3N
1376013253587		PROPELLANT GRAIN, HPC-23N
1376013253588		PROPELLANT GRAIN, HPC-1N
1376013255071		PROPELLANT GRAIN F/IMPULSE CTG CCU-56A
1376013255072		PROPELLANT GRAIN F/IMPULSE CTGS CCU-1B,11B
1376013255073		PROPELLANT GRAIN, M2 PROPELLANT
1376013255075		PROPELLANT POWDER, HPC-60 F/IMPULSE CTG CCU-106A
1376013255113		PROPELLANT GRAIN F/IMPULSE CTGS M141/146
1376013255114		PROPELLANT GRAIN F/IMPULSE CTG M37
1376013255115		PROPELLANT GRAIN, M8 PROP F/IMPULSE CTGS M43/44A
1376013255116		PROPELLANT GRAIN, M6 PROP F/IMPULSE CTG MK 18
1376013255117		PROPELLANT GRAIN F/DELAY CTG CCU-73A
1376013255118		PROPELLANT GRAIN F/IMPULSE CTG CCU-44A1
1376013355054		PROPELLANT POWDER, WC867 F/20MM CTG
1376013423843		PROPELLANT POWDER, **M10** F/IMPULSE CTG M42A1
1376013423844		PROPELLANT POWDER, **IMR** 5010
1376013626503		PROPELLANT POWDER, PROP WC 750
1376013687116		PROPELLANT POWDER, PROP WC 845 F/5.56MM TR&BALL
1376013706678		PROPELLANT POWDER, WCR845 F/TR M856
1376013735883		PROPELLANT GRAIN F/120MM M865
1376013960257		PROPELLANT, M14 GRANULAR, MULTI-PERFORATION, FOR CARTRIDGE, 120MM, TP-T, M831E2
1376014261542		PROPELLANT, M1, GLAZED, FOR USE IN CARTRIDGE, 120MM, TPCSDS-T, M865E2
1376014891519		PROPELLANT, PAP 7993, TYPE 1 (MULTIPLE-PERFORATED GRANI), FOR USE IN THE 155MM PROPELLING CHARGE, M231, ZONE 1 AND 2
1376015266467		PROPELLANT, M31A1E1 WITH DECOPPERING AGENT, M31A2 FOR USE IN CHARGE, PROPELLING, 155MM, M232E1/A1
1376015875313		PROPELLANT, M9, FLAKE, FOR 81MM CARTRIDGES
1376015927660		PROPELLANT POWDER, WC 868 F/CTG, 20MM

APPENDIX D NOMINAL PROPELLANT COMPOSITIONS

(The Numbers in These Charts are Approximate Percentages by Weight[1])

	PROPELLANT TYPE									
INGREDIENT	M1	M2	M5	M6	M7	M8	M9	M10	M12	M13
Nitrocellulose (NC)	85.00	77.45	81.95	87.00	54.60	52.15	57.75	98.00	97.70	57.30
Nitroglycerin (NG)		19.50	15.00		35.50	43.00	40.00			40.00
Nitroguanidine (NQ)										
Dinitrotoluene (DNT)	10.00			10.00						
Dibutylphthalate (DBT)	5.00			3.00						
Diethylphthalate						3.00				
Diphenylamine (DPA)	1.00			1.00				1.00	0.80	0.20
Ethyl Centralite (EC)		0.60	0.60		0.90	0.60	0.75			1.00
Barium Nitrate		1.40	1.40							
Potassium Nitrate		0.75	0.75			1.25	1.50			
Potassium Perchlorate					7.80					
Lead Carbonate	1.00									
Potassium Sulfate	1.00			1.00				1.00	0.75	1.50
Tin									0.75	
Carbon Black					1.20					0.05
Graphite		0.30	0.30					0.10		
Cryolite										

THIS CHART CONTINUES ON THE NEXT PAGE

[1] The information contained in this chart is an approximation only. Specific information regarding percentages and tolerances of ingredients should be obtained from the appropriate specifications and standards, or MIDAS (see paragraph 6-8). This listing is not a collection of all propellant compositions used by the military, but rather only examples of some typical compositions.

NOMINAL PROPELLANT COMPOSITIONS

(The Numbers in These Charts are Approximate Percentages by Weight[1])

	PROPELLANT TYPE							
INGREDIENT	M14	M15	M16	M17	M18	M26	M26A1	M28
Nitrocellulose (NC)	90.00	20.00	55.00	22.00	80.00	67.35	68.70	60.00
Nitroglycerin (NG)		19.00	27.50	21.50	10.00	25.00	25.00	23.00
Nitroguanidine (NQ)		54.70		54.70				
Dinitrotoluene (DNT)	8.00		10.50					
Dibutylphthalate (DBT)	2.00				9.00			
Dimethylphthalate								2.60
Diphenylamine (DPA)	1.00				1.00			
2-nitrodiphenylamine								1.70
Ethyl Centralite (EC)		6.00	4.00	1.50		6.00	6.00	
Barium Nitrate						0.75		
Potassium Nitrate						0.70		
Potassium Perchlorate								
Lead Stearate			0.50					2.00
Potassium Sulfate			1.50					
Triacetin								9.90
Carbon Black			0.50					
Graphite				0.10		0.30	0.30	
Cryolite		0.30		0.30				
2-Dinitrophenyldiamine								

NOMINAL PROPELLANT COMPOSITIONS

(The Numbers in These Charts are Approximate Percentages by Weight[1])

	PROPELLANT TYPE						
INGREDIENT	M30MOD	M30A1	M30A2	M30	M31	M31A1	IMR
Nitrocellulose (NC)	40.50	28.00	27.00	28	20.00	20.00	100.00
Nitroglycerin (NG)	32.70	22.50	22.50	22.5	19.00	19.00	
Nitroguanidine (NQ)		47.00	46.25	47.7	54.70	54.00	
Dinitrotoluene (DNT)							8.00
Dibutylphthalate (DBT)					4.50	4.50	
Diethylphthalate							
Diphenylamine (DPA)							0.70
2-nitrodiphenylamine						1.50	
Ethyl Centralite (EC)	1.50	1.50	1.50	1.5			
Barium Nitrate							
Potassium Nitrate			2.75				
Potassium Perchlorate							
Lead Carbonate							
Potassium Sulfate		1.00			1.50	1.50	1.00
Tin							
Carbon Black							
Graphite		0.15	0.15	0.1			
Cryolite	0.30			0.3	0.30		
2-Dinitrophenyldiamine					1.50		

SUBSTITUTES AND ADDITIVES USED IN PROPELLANT COMPOSITION

PURPOSE	Reduce Hygroscopicity	Stabilizer	Plasticizer	Deterrent	Reduce Flame Temperature	Reduce Flash	Reduce Bore Erosion	Increase Electrical Conductivity	Control Burning Rate	Source of Oxygen	Retards Ignition	Increases Ignitability	Moisture Proof Coating
MATERIAL													
Nitroglycerin	X		X							X		X	
Nitroguanidine					X	X	X						
Dinitrotoluene	X		X	X			X		X				X
Dibutylphthalate	X		X	X	X	X	X		X				
Diethylphthalate						X	X		X				
Diphenylamine*		X											
Ethyl Centralite**	X	X	X	X	X	X	X		X				X
Barium Nitrate						X							
Potassium Nitrate						X							
Potassium Perchlorate						X			X	X			
Potassium Sulphate						X							
Tin (Lead)***													
Carbon Black								X			X		
Graphite													
Cryolite						X							
2-Dinitrophenyldiamine		X	X										
Methyl Centralite			X	X		X	X		X				
Triacetin			X			X							

* Stabilizer for single base propellant
** Stabilizer for double base propellant
*** Decoppering or weapon cleaning agent

APPENDIX E USMC PROPELLANT MANAGEMENT AIN 021-2000

This appendix consists of a reprint of the Navy Ammunition Information Notice 021-2000, Subject: Propellant and Propelling Charges Management.

The Official Source for this document is NAVSUP P-801/TWO24-AA-ORD-010, Appendix A and may be accessed on the Naval Ammunition Logistics Center (NALC) home page at www.nalc.navy.mil

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SUBJ: PROPELLANT AND PROPELLING CHARGES MANAGEMENT

This AIN supersedes NOC IMSD AINs 008-99/024-95/003-87/011-90 (DTGS 081935Z DEC 98, 071935Z JUL 95, 211945Z NOV 86, and 011925Z MAR 90).

This AIN applies to US Marine Corps stock only. Distribute information in this AIN to all Navy and USMC organizations managing or storing propellant.

The Marine Corps and other services monitor the chemical stability of stored propellant. Testing occasionally identifies ammunition lots that have hazardous stabilizer loss and are no longer safe for continued storage. When USMC ammunition (OT COG Class V (W) Materiel) is so identified, Notices of Ammunition Reclassification (NARs) are issued IAW TW024-AA-ORD-010 AMMUNITION UNSERVICEABLE, SUSPENDED AND LIMITED USE. Subj NARs will include a time limit before which the propellant must be destroyed. IAW CFR 40 DTD 12 AUG 97 (Title 40 Protection of the Environment Subpart M When Military Munitions Become Solid and Hazardous Waste Subject to Regulation) and MRIP DTD 01 JUL 97 (The DOD Munitions Rule Implementation Policy, Established the DDA Process for Excess and Unserviceable Munitions). These items become hazardous waste immediately upon NAR issuance and must be managed IAW MRIP DTD 01 JUL 97.

Accordingly, storing activities must request disposition instructions from the USMC DDA. The DDA will evaluate available options and provide coordinated disposition instructions. Requests may be submitted via either e-mail to **DDA@MCSC.USMC.MIL** or Naval Msg to COMMARCORSYSCOM QUANTICO VA//AM-EES//. Requests for Class V (A) Aviation Assets will be addressed to the cognizant program manager.

All requests shall contain the following information:

(A) DODIC
(B) NOMENCLATURE
(C) QUANTITY
(D) CONDITION CODE

(E) APPLICABLE NAR, AIN, OR REASON(S) PROMPTING LOCAL CONDITION CODE CHANGE.
(F) ANY OTHER INFORMATION PERTINENT TO THE REQUEST (I.E., AVAILABILITY OF STORAGE UNDER CONDITIONAL EXEMPTION (CE), RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) PERMITTED TREATMENT FACILITY STATUS, ETC.).

Loose, mixed, cut, wet, or otherwise suspect propelling charges or propellant.

(A) Storage activities managing USMC propelling charges or propellant that may be suspect will initially contact EOD for determination whether an emergency response or imminent and substantial endangerment exists, governed by MRIP DTD 01 JUL 97, Chapter 9. If EOD determines suspect propelling charges or propellant are safe to store and transport, the storage activity will request Munitions Disposition Instructions from the DDA within 3 days of EOD determination.

(B) Suspect propelling charges or propellant include:

(1) Charges or Propellant removed from cartridge ammunition, commonly referred to as an “all up round.”

(2) Excess charges removed from propelling charge assemblies (cut charges)

(3) Propellant charges that are leaking or that cannot be identified to include propelling charges that are “MIXED” or “UNKNOWN.”

(4) Propelling charges that are contaminated, loose, mixed, wet, soaked, or moldy.

Lessons learned from similar NAR actions include:

Completion of Hazardous Waste (HW) manifest must be coordinated with both shipping and receiving installation environmental offices prior to shipment;
For continuity and record keeping purposes, installation Environmental Office personnel authorized to sign for HW manifest should sign at both shipping and receiving installations;
Treatment must be accomplished within the time parameters specified in the disposition instructions;
Transportation coordination should be accomplished by respective TMO offices since carriers have to meet EPA and DOT HW and explosives transportation licensing requirements.

Documentation to Include:

The applicable NAR;
DDA's Munitions Disposition Instructions;
DODIC;
And quantity will be maintained by the shipping storing activity for a minimum of three years.

The USMC Munitions Management Policy Msg for Unserviceable and Waste Class V (W) Materiel (DTG 151237Z NOV 99 COMMARCORSYSCOM) amplifies current USMC munitions management policy for unserviceable and waste Class V (W) materiel. Request direct all questions regarding this policy to the USMC DDA, Mr. Wayne Johns, COMMARCORSYSCOM (APMM-116), DSN: 378-8772, COMM: (703) 432-8772,.

APPENDIX F DAC PUBLICATIONS & AmmoHelp

A source of technical assistance is an integral element of the DAC Logistics Review and Technical Assistance Office. Commands, activities and installations can request technical assistance from LRTAO on matters pertaining to security, storage, demilitarization, testing and use of ammunition and explosives, facility layout and construction programs, or any subject applicable to their ammunition mission. Services of ammunition Logistics Management Specialists and QASAS are available on a TDY basis or for telephonic consultation. The mail and email addresses are listed in the preface and in Appendix G, and the main office telephone is DSN 965-8180, (918) 420-8180.

DAC LRTAO Publications available on-line at https://www3.dac.army.mil

The Yellow Book

Properly titled "Hazard Classification of United States Military Explosives and Munitions," Revision 15, June 2012. An at-your-fingertips reference for most commonly used ammunition classification data, such as explosives weights, security codes, hazard classification/division, storage compatibility, etc.

Ammunition Logistics - Guide to Operations in a Retail Environment

Written especially, though not exclusively, for the soldier, this Guide is a great "how-to" source for many ASP responsibilities. The decline of personnel and financial resources continues to be a factor in many of the inefficiencies observed by DAC review teams. This guide is a means of disseminating trends and observations, so self-reviews can be performed and corrective actions initiated.

Propellant Management Guide

This guide provides information about the propellant test activities at the propellant laboratories, and offers methods and procedures for the safe and efficient storage and management of propellants and propelling charges. The JOCG Propellant Safety Surveillance Board endorses the guide, and SB 742-1 recommends its use.

Review Program Digests

At the end of each fiscal year, the LRTAO prepares and distributes summaries of significant observations and trends reported during ammunition logistics reviews conducted during the fiscal year. Digests are prepared and distributed as an aid in identifying potential problem areas that could affect an installations capability to accomplish its ammunition mission in an accountable, secure, safe, efficient, and environmentally responsible manner.

DAC AmmoHelp

AmmoHelp is DAC's newest and most accessible means to better serve the Army and associated personnel. **AmmoHelp** allows any customer to ask any sort of question about ammunition and explosives: logistics, safety, surveillance, training,

demilitarization technology or engineering. The DAC directorate having the expertise to provide definitive guidance will answer the question.

You may submit an **AmmoHelp** question 2 ways listed below:

https://dac.jmc.army.mil/AmmoHelp/OpenAccess/AskQuestion.aspx

usarmy.mcalester.usamc.list.dac-ammohelp@mail.mil

APPENDIX G POINTS OF CONTACT

DAC: Logistics Review and Technical Assistance Office

Mail Address: Defense Ammunition Center
JMAC-AV
Building 2
1 C Tree Road
McAlester, OK 74501

Telephone: DSN 956-8590, (918) 420-8590
E-mail: usarmy.mcalester.jmc.list.dac-av-personnel-dl@mail.mil

JMC: Ammunition Surveillance Division

Mail Address: Joint Munitions Command
AMSJM-QAS
1 Rock Island Arsenal
Rock Island, IL 61299-6000

Telephone: DSN 793-6982, (309) 782-6982
E-mail: amc.rock.org.jmc-amsjm-qas@mail.mil
SharePoint Site: https://jmcsp.osc.army.mil/sites/mlrc/qa/qas/qasurveillance/default.aspx

ARDEC/PICATINNY: Army Propellant Surveillance Laboratory

Mail Address: ARDEC
Army Propellant Surveillance Laboratory
Attn: RDAR-MEE-P, Building 3028
Picatinny Arsenal, NJ 07806-5000

Individual Contact: **Nathan Zink**
Telephone: DSN 880-3339 (973) 724-3339
E-mail: nathan.zink@us.army.mil.

NSWC INDIAN HEAD: NAVSEA Gun Propellants

Mail Address: NSWC IHDIV Explosive Scales
Attn: NGPS, Code E17
5006 Safe Haven Way
Indian Head, MD 20640-5035

Individual Contact: **Thomas Crowley**
Telephone: DSN 354-1435, (301) 744-1435
E-mail: thomas.w.crowley@navy.mil
Website: http://www.ih.navy.mil

NAVAL AIR at CHINA LAKE

Mail Address: Commanding Officer
Naval Air Warfare Center, Weapons Division
Attn: Loretta Lusk
2400 E. Pilot Plant Road
China Lake, CA 93555-6100

Individual Contact: **Loretta Lusk**
Telephone: DSN 437-1755, (760) 939-1755
E-mail: loretta.lusk@navy.mil

UNITED STATES MARINE CORPS GUN PROPELLANTS

Mail Address: Commander
Expeditionary Systems Evaluation Division
NSWC Crane, Detachment Fallbrook
ATTN: Code JXPLM (Dr. Ryan Olsen)
700 Ammunition Road
Fallbrook, CA 92028-3187

Individual Contact: **Dr. Ryan Olsen**
Telephone: DSN 873-3834, (760) 731-3834
E-mail: ryan.olsen@navy.mil