



DEPARTMENT OF THE NAVY

NAVY MEDICAL COMMAND  
WASHINGTON, D.C. 20372-5120

IN REPLY REFER TO

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34vs/03417 of 30 Mar 89

From: Commander, Navel Medical Command  
To: Commander, Naval Sea Systems Command (SEA56Y14), Naval Sea  
Systems Command Headquarters, Washington, D.C. 20362-5101

Subj: SUBMARINE MATERIALS EVALUATION - MILITECH NO. 1 METAL  
CONDITIONER

Ref: (a) NAVTECH Manual S9510-AB-ATM-010/(C)

1. Forwarded, concurring with the recommendation that the  
subject named material be placed in the LIMITED usage category  
per reference (a).

*W. A. BUCKENDORF*  
W. A. BUCKENDORF  
Deputy Commander for Fleet  
Readiness and Training

Copy to:  
NAVENVIRHLTHCEN NORFOLK



DEPARTMENT OF THE NAVY  
NAVY ENVIRONMENTAL HEALTH CENTER  
NAVAL STATION  
NORFOLK, VIRGINIA 23511-6695

6266  
Ser 34vs/03417  
30 Mar 89

From: Commanding Officer, Navy Environmental Health Center  
To: Commander, Naval Sea Systems Command (SEA 56Y14), Naval Sea Systems  
Command Headquarters, Washington, DC 20362-5101  
Via: Commander, Naval Medical Command (MEDCOM-02)

Subj: SUBMARINE MATERIALS EVALUATION - MILITEC NO. 1 METAL CONDITIONER

Ref: (a) NAVTECH Manual S9510 AB ATM 010/(C)

End: (1) Technical Documentation Package for Militec No. 1 Metal Conditioner

1. Enclosure (1) was evaluated by the Submarine Materials Review Board of this Command. Based on information provided, we recommend Militec No. 1 Metal Conditioner be placed in the LIMITED usage category, in accordance with reference (a). It is understood that this material will be used in air compressor lubricating oil as a supplement, at a concentration of approximately 2 ounces per quart. It is anticipated that the oil/supplement mixture will be replaced every 3,000 to 4,000 hours of compressor operation.
2. It is recommended that the manufacturer's Material Safety Data Sheet be consulted for specific health hazard control guidance. Areas of particular concern are delineated in the following paragraphs.
3. Personnel should avoid skin contact with this product. Use of rubber gloves is recommended when handling open containers of the material and when handling mixtures of Militec No. 1 Metal Conditioner and lubricating oil.
4. Personnel working with this material should wash all potentially exposed skin areas with soap and water, at breaks, and at the conclusion of the operation or shift.
5. Clothing contaminated with this material or lubricating oil/metal conditioner mixtures should be removed as soon as feasible and laundered prior to reuse.
6. An American National Standards Institute approved source of potable water for emergency eye flushing should be readily available near operations involving the handling/dispensing of this metal conditioner, should its use be required. In the event of eye contact with the material, flush eyes thoroughly with potable water for 15 minutes and then seek prompt medical attention.
7. Chemical worker's goggles, supplemented by a face shield where splashing of the material could occur, should be worn whenever personnel are handling open containers of the metal conditioner.



Subj: SUBMARINE MATERIALS EVALUATION - MILITEC NO. 1 METAL CONDITIONER

8. Militec No. 1 Metal Conditioner should be stored in approved areas, isolated from incompatible materials such as strong oxidizing and reducing agents.

9. Point of contact on this subject is Mr. James R. Crawl, Head, Hazardous Materials Department, AUTOVON: 564-4657; Commercial: (804) 444-4657.

  
**J.R. CRAWL**  
By direction



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NAVAL COASTAL SYSTEMS CENTER  
Panama City, Florida 32407-5000

REPORT NUMBER: TM-89-026  
26 JANUARY 1989

SUBMARINE MATERIALS  
ATMOSPHERE CONTAMINATION  
SOURCE CONTROL PROGRAM—  
OFF-GASSING ANALYSIS OF  
MILITEC #1 METAL CONDITIONER

By

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Prepared for

NAVAL SEA SYSTEMS COMMAND  
CODE SEA 56Y14  
WASH DC 20362

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## ABSTRACT

A sample of Militec #1 Metal Conditioner manufactured and supplied by Militec, Inc. was analyzed to determine its off-gassed components.

One gram of the material, as received, was heated at 65 degrees C (150 degrees F) for twenty-four hours in a sealed stainless steel cylinder and the resulting atmosphere analyzed as requested. Another one-gram sample was heated at 30 degrees C (86 degrees F) for twenty-four hours in a sealed stainless steel cylinder and the resulting atmosphere analyzed as requested.

Under these conditions, no major components were off-gassed from the sample. No aromatic or halogenated hydrocarbons were detected in the out-gassed sample.

We recommend that the Navy Environmental Health Center review this data and recommend a submarine usage category for this material.

## INTRODUCTION

The Gas Analysis Laboratory is part of the Ocean Engineering Department. Diving and Salvage Division. Underwater and Advanced Concepts Branch located at the Naval Coastal Systems Center, Panama City, Florida. The Gas Analysis Laboratory supports the Ocean Simulation Facility (OSF). Naval Diving and Salvage Training Center (NDSTC) hyperbaric chambers, and is the lead laboratory for the Navy-wide Gas Analysis Program for Scuba Air Analysis. This laboratory is responsible for off-gassing analyses at the OSF, EDF, NDSTC, SDV Programs, and MK 12, and EX 14 diving systems. This work at the Gas Analysis Laboratory has been an on going project for over fifteen years.

Potential chemical hazards to personnel may arise from personal contact with the material or from substance off-gassed or possibly volatilized into the submarine's atmosphere.

The Gas Analysis Laboratory determined the off-gassed characteristics of samples of Militec #1 Metal Conditioner when heated at 65 degrees C (150 degrees F) and 30 degrees C (86 degrees F) for twenty-four hours in a sealed stainless steel container. The 65 degrees C temperature was chosen because: (1) it is considered to be the maximum temperature to which the material would be exposed during normal usage, excluding catastrophic circumstances such as would arise during a fire, and (2) the elevated temperature provides a means of accelerating the off-gassing of volatile components. The chosen off-gassing conditions usually are more severe than those to which the material would normally be exposed aboard submarines. Since these off-gassing studies were done under static conditions (i.e., no atmospheric renewal), they represent worst-case conditions. Air circulation and purification systems are standard equipment of submarines; therefore, off-gassed products would not be expected to build up as they would under the conditions used during this study.

## BACKGROUND INFORMATION

### MANUFACTURER'S DATA

Militec #1 Metal Conditioner is a lubricant, which is used to reduce friction from metal-to-metal contact.

## INSTRUMENTATION

Total hydrocarbons were determined with a total hydrocarbon analyzer. This instrument uses a flame ionization detector system. The organics were identified as methane equivalents. The sensitivity of this method is 0.45 parts per million (ppm).

Light hydrocarbons (C1 to C6) were determined using a gas chromatograph equipped with a Forapak Q column, 213 x 0.32 cm (7 feet x 1/8 inch) and utilizing a flame ionization detector. This particular column is type 316 stainless steel. Flame ionization gas chromatography has a detection limit of 0.1 ppm for many organic compounds.

Heavy hydrocarbons (C6 to C18) were determined with a gas chromatograph using a flame ionization detector and a 183 x 0.32 centimeter (6 feet x 1/8 inch) stainless steel column packed with 10 percent OV-101 on Chromosorb W-HF. Flame ionization gas chromatography has a detection limit of 0.1 ppm for many organic compounds.

Total halogenated hydrocarbons were determined with a total halogen analyzer. This instrument uses an ionization type of detector, which responds only to halogenated hydrocarbons. The detection limit of the instrument is 0.5 ppm for most halogenated hydrocarbons.

Individual halogenated hydrocarbons were determined with a gas chromatograph using an electron capture (Ni 63) detector and a 305 x 0.32 cm (10 feet x 1/8 inch) nickel column packed with Chromosorb 102. Electron capture gas chromatography has detection limit of 0.01 ppm (or better) for many halogenated hydrocarbons.

Carbon monoxide was determined using a non-dispersive infrared analyzer equipped with a CO detector. The detection limit of this instrument is 0.3 ppm.

The Gas Analysis Laboratory is also equipped with a mass spectrometer/gas chromatograph system. This mass spectrometer is a quadrupole instrument with a 55-megabyte computer system and a NBS library containing 38,500 compounds. The mass range of this mass spectrometer is 10-800 AMU. The gas chromatograph uses a flame ionization detector and a 45.7 x 0.32 cm (1.5 feet x 1/8 inch) stainless steel column packed with Molecular Sieve 13X, and a 12 meter x 0.2 mm capillary column glass packed with cross linked methyl silicone. This capillary column serves as an interface between the packed columns and the mass spectrometer. This instrument is used to identify organic compounds, which are difficult to analyze using a gas chromatograph.

## OFF-GASSING EVALUATION PROCEDURES

A sample material of known weight or surface area is placed in a Farr Oxygen Bomb of known internal volume. Sample size will determine the final volume of the out-gassing chamber. This off-gassing chamber has been a pre-cleaned and blank background runs obtained under conditions identical to the final material's off-gassing evaluation to ensure a zero hydrocarbon background. The chamber containing the sample material is then charged with high purity (zero) air, normally 6800 cc ambient, and conditions. Charging pressure depends on the internal volume of the oxygen bomb. The hydrocarbon content of the contained sample material is then allowed to equilibrate with the zero air for four hours at 130 degrees F or another acceptable temperature, before gas analysis (low ppm level) for specific and total hydrocarbons is accomplished. The gas analysis is performed while the sample is still at the specified temperature. Gas analyses are obtained by utilizing the following equipment: gas chromatographs equipped with flame ionization, thermal conductivity, and electron capture detectors, total hydrocarbon analyzer, total halogenated hydrocarbon analyzer, non-dispersive infrared analyzer, and a mass spectrometer/ gas chromatograph. Other instruments may be used for special requirements.

## RESULTS

### OBSERVATION

The Militec #1 Metal Conditioner is red in color and transparent. It possesses a strong petroleum odor. It was received in a glass bottle.

### OFF-GASSED COMPONENTS

The analysis results for the off-gassed components of Militec #1 Metal Conditioner are listed in Tables 1 and 2. These results are expressed as the concentration (ppm) of out-gassed components that would have been produced by a one-gram sample of the material in one liter of air to facilitate interpretation of data. There were no major components off-gassed from the sample. No aromatic or halogenated hydrocarbons were detected in the out-gassed products.

TABLE 1. OFF-GASSED COMPONENTS OF  
MILITEC #1 METAL CONDITIONER  
HEATED AT 30°C (86°F) FOR TWENTY-FOUR HOURS

Test Date: 2 December, 1988  
Chamber Size: 1,000 cc  
Fill Pressure: 100 psig  
Sample Weight: 0.3740 g

<u>Out-Gassed Components</u>	<u>Out-Gassed Levels in Air</u>	
	<u>ppm</u>	<u>ppm/g/L*</u>
Total Hydrocarbons (as methane)	0.6	10.6
Total Halogens (as methyl chloride)	<0.5	<9.2
Carbon monoxide	1.1	20.1
Methane	<0.1	<1.9
Acetylene	<0.1	<1.9
Acetone	<0.1	<1.9
Freon 113	<0.1	<1.9
Methyl Ethyl Ketone	<0.1	<1.9
Benzene	<0.1	<1.9
Toluene	<0.1	<1.9
Aldehydes (as formaldehyde)	<0.1	<1.9

\* ppm/g/L – Normalized for a one gram sample in one liter of air.

TABLE 2. OFF-GASSED COMPONENTS OF  
MILITEC #1 METAL CONDITIONER  
HEATED AT 85°C (150°F) FOR TWENTY-FOUR HOURS

Test Date: 2 December, 1988  
 Chamber Size: 1,000 cc  
 Fill Pressure: 100 psig  
 Sample Weight: 0.3540 g

<u>Out-Gassed Components</u>	<u>Out-Gassed Levels in Air</u>	
	<u>ppm</u>	<u>ppm/g/L*</u>
Total Hydrocarbons (as methane)	1.3	23.9
Total Halogens (as methyl chloride)	<0.5	<9.7
Carbon monoxide	1.2	17.2
Methane	<0.1	<2.0
Acetylene	<0.1	<2.0
Acetone	<0.1	<2.0
Freon 113	<0.1	<2.0
Methyl Ethyl Ketone	<0.1	<2.0
Benzene	<0.1	<2.0
Toluene	<0.1	<2.0
Aldehydes (as formaldehyde)	<0.1	<2.0

\* ppm/g/L – Normalized for a one gram sample in one liter of air.

#### GLOVE BOX COMPONENTS

The glove box was not run because the sample exhibited little off-gassing in the pressurized and heated conditions presented in the Farr Oxygen Bombs and because it was in a liquid state as it was being run in the Farr Oxygen Bombs.

#### CONCLUSIONS

There was a total of 10.6 ppm total hydrocarbons off-gassed from the one gram sample at 30 degrees C and 23.9 ppm was off-gassed at 65 degrees C. The glove box tests were not performed on this sample.

#### RECOMMENDATIONS

We recommend that the Navy Environmental Health Center review this data and recommend a submarine usage category for this material.