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**Evaluation of Combustion Products of
Used Harvey's Vapo-Steril Solution
Brooks AFB TX**

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Final Report

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13. ABSTRACT (Maximum 200 words) This report discusses the findings and recommendations of the study conducted to evaluate the possibility of any hazardous decomposition products during the combustion of Used Harvey's Vapo-Steril solution. Results indicate the Used Harvey's Vapo-Steril solution may be used as a fuel-grade methanol substitute for alcohol torches by dental clinic personnel.				
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I. INTRODUCTION

A. USAF School of Aerospace Medicine, Dental Investigation Service (USAFSAM/NGD) requested Air Force Occupational and Environmental Health Laboratory (AFOEHL) conduct a study to determine the various chemical products resulting from the combustion of used Harvey's Vapo-Steril solution and if they are hazardous to the workers using the alcohol torches and lamps.

B. This technical report discusses the findings and recommendations of our study conducted by Capt Kul B. Garg, Capt Michael J. Mader, and SSgt Daniel C. Schillings on 6 Nov 89, and 31 Jan and 21 Feb 90. Lt Col (Dr) Shannon E. Mills was USAFSAM/NGD Project Scientist on this study and provided assistance throughout this study.

II. BACKGROUND

A. MDT Chemiclave sterilizers are widely used in USAF dental clinics. These sterilizers use Harvey's Vapo-Steril solution as a sterilizing agent and may generate significant quantities of used Harvey's Vapo-Steril solution that must be disposed of. The Dental Investigation Service branch of USAF School of Aerospace Medicine (USAFSAM/NGD) is investigating the feasibility, safety, and cost effectiveness of using used Harvey's Vapo-Steril solution as a substitute for fuel-grade methanol presently used in alcohol torches and lamps in the clinics.

B. The purpose of our study was to determine (1) the various ingredients of Harvey's Vapo-Steril, and Used Harvey's Vapo-Steril by analyzing their bulk samples, (2) various products produced during the combustion of fuel-grade methanol, Harvey's Vapo-Steril solution, and Used Harvey's Vapo-Steril solution, and (3) if the various combustion products are hazardous to workers using alcohol torches and lamps.

III. FINDINGS

A. Harvey's Vapo-Steril solution (NSN 6850-00-148-9776), manufactured by MDT Biologic Company, is used in MDT chemiclave sterilizers where the various dental instruments are sterilized. Before sterilization, these instruments are treated with A-Dec's handpiece spray lubricant.

A bulk sample of the handpiece spray lubricant was collected and analyzed by AFOEHL Analytical Services Division (AFOEHL/SA) using an infrared spectrograph. It was determined to be a mixture of Freon-113 (1,1,2-trichloro-1,2,2-trifluoroethane) and petroleum oil. Bulk samples of Harvey's Vapo-Steril solution and used Harvey's Vapo-Steril solution (a sample obtained from one of the USAF dental clinics, a worst case contaminated sample) were collected and analyzed by AFOEHL/SA using infrared spectrograph. The compositions given in material safety data sheet (MSDS) provided by the manufacturer, and determined by analysis are tabulated in Table i.

By _____
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TABLE 1. COMPOSITION OF HARVEY'S VAPO-STERIL AND USED HARVEY'S VAPO-STERIL

Ingredient Name	Harvey's Vapo-Steril		Used Harvey's Vapo-Steril Analysis(%)
	MSDS(%)	Analysis(%)	
Ethyl alcohol	75	70	65
Isopropyl alcohol	10	10	6
Methyl alcohol	4	5	2
Acetone	1	2	-
Methyl ethyl ketone	1	3	-
Tert. butyl alcohol	0.2	0.8	-
Formaldehyde	0.25	0.2	-
Water	Unknown	9	25
Freon-113	-	-	1
Petroleum oil	-	-	1

B. Air samples were collected in gas sampling bags (nonpermeable bonded 5-layer plastic bags designed by Calibrated Instruments Inc.) near the flame of an alcohol torch while using fuel-grade methanol, Harvey's Vapo-Steril solution, and used Harvey's Vapo-Steril solution as fuel in the torch (see figure). The air samples were analyzed by AFOEHL/SA using infrared spectrography. In addition, Draeger's color detector tubes (manufactured by National Draeger, Inc.) were used to perform real-time monitoring near the flame to determine if formaldehyde, phosgene, hydrogen fluoride, and hydrochloric acid were being produced during the combustion (expected in very

**Air Sampling During the Combustion of Used Harvey's Vapo-Steril**

small concentrations, if any). The air sampling results are tabulated in Table 2. Other than slightly elevated levels of carbon dioxide and 2-4 ppm of ethanol vapors no other contaminants were detected during the analysis of the air samples.

TABLE 2. VARIOUS COMBUSTION PRODUCTS DURING THE USE OF FUEL-GRADE METHANOL, HARVEY'S VAPO-STERIL, AND USED HARVEY'S VAPO-STERIL AS FUEL IN DENTAL TORCH

Combustion Products	Fuel grade methanol	Harvey's Vapo-Steril New	Harvey's Vapo-Steril Used	Detection Limit
<u>Bag Sampling:</u>				
Carbon Dioxide	SE*	SE	SE	0.4 ppm
Carbon monoxide	ND*	ND	ND	2.1 ppm
Ethanol	2 ppm	ND	4 ppm	0.3 ppm
<u>Draeger Detector Tubes:</u>				
Formaldehyde	-	ND	ND	0.5 ppm
Phosgene	-	ND	ND	0.04 ppm
Hydrogen fluoride	-	ND	ND	1.5 ppm
Hydrochloric acid	-	ND	ND	1.0 ppm

*

ND= none detected, i.e., below detection limit

SE= slightly elevated levels compared to levels in ambient air

IV. CONCLUSIONS

A. Harvey's Vapo-Steril solution contains small amounts of acetone (2%) and formaldehyde (0.25%), in addition to various types of alcohols. During the sterilization process, formaldehyde and acetone present in Harvey's Vapo-Steril solution are evaporated; but, a small amount of A-Deck's handpiece spray lubricant (a mixture of petroleum oil and freon-113) sprayed on dental instruments contaminate the Harvey's Vapo-Steril solution.

B. During the combustion in alcohol torches, fuel-grade methanol, Harvey's Vapo-Steril solution and used Harvey's Vapo-Steril solution form a product mixture containing slightly elevated levels of carbon dioxide, 2-4 ppm of ethanol and other contaminants (if any) below detection limit.

V. RECOMMENDATION

Used Harvey's Vapo-Steril solution may be used as a fuel-grade methanol substitute for alcohol torches by personnel in the dental clinics as it does not generate hazardous decomposition products.

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