

California Environmental Protection Agency



**PERMEATION RATES OF WEDCO FLUORINATED
HIGH DENSITY POLYETHYLENE PORTABLE FUEL CONTAINERS**

Engineering and Certification Branch
Monitoring and Laboratory Division

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Permeation Rates of Wedco Fluorinated High Density Polyethylene Portable Fuel Containers

Introduction

The California Air Resources Board (CARB) staff tested several Wedco High-Density Polyethylene (HDPE) portable fuel containers (containers) to determine average permeation rates. Wedco submitted several 2.5 gallon and 5 gallon portable fuel containers to the CARB staff for evaluation. All the containers were treated with fluorination, 2.5 gallon containers were treated at level 5 and 5 gallon containers were treated at level 3 (higher level of fluorination represents higher resistance to permeation). Containers were preconditioned with commercial fuel, refilled with Phase II California Reformulated Certification (CERT) fuel, and subjected to a variable temperature profile. Permeation rates were then determined gravimetrically during the month of December 2000.

Test Protocol

Wedco submitted a total of 10 containers in October 2000. In October, 10 containers underwent the durability and preconditioning process, using commercial fuel, per CARB Test Method 513. All containers were stored at ambient temperature and pressure in flammable storage cabinets. After four weeks of ambient preconditioning, the containers were emptied; blown dry with compressed zero air, and immediately refilled with CERT fuel. The containers were then sealed using a hand held fusion welder and 1/4" thick HDPE coupons and leak tested as specified in Test Method 513 (a copy can be found at the CARB web site: <http://www.arb.ca.gov/regact/spillcon/spillcon.htm>).

Weight loss was used to determine relative permeation rates. Sealed containers were weighed using a high capacity balance with a sensitivity of ± 0.1 grams. After each container was weighed and the weight recorded, they were placed in the Sealed Housing for Evaporative Determination (SHED) and exposed to a variable temperature profile (see Attachment 1). This process is considered our diurnal cycle (recurring every day). Containers were then post weighed after each 24-hour diurnal cycle and the weight loss calculated.

Results

Cumulative weight losses were determined for each container as a function of time. The containers underwent a total of thirteen diurnal cycles, but results are calculated using only ten cycles, each cycle is 24-hours. The first three days of test data were not used in determining individual per container permeation rates due to high variability. A summary of all test results can be found in Attachment 2.

The average permeation rate from the 2.5 gallon containers at Level 5 fluorination designated W25L5-1 through W25L5-5 was determined to be 0.06 grams/gallon/day.

This rate is based on data averaged from tests of five individual containers and represents a total of 50 individual 24-hour diurnal cycles.

The average permeation rate from the 5 gallon containers at Level 3 fluorination designated W5L3-1 through W5L3-5 was determined to be 0.08 grams/gallon/day. This rate is based on data averaged from tests of five individual containers and represents a total of 50 individual 24-hour diurnal cycles.

Attachment 1

SHED Temperature Test Profile

Hour	Minute	Temperature (°F)
0	0	65.0
1	60	66.6
2	120	72.6
3	180	80.3
4	240	86.1
5	300	90.6
6	360	94.6
7	420	98.1
8	480	101.2
9	540	103.4
10	600	104.9
11	660	105.0
12	720	104.2
13	780	101.1
14	840	95.3
15	900	88.8
16	960	84.4
17	1020	80.8
18	1080	77.8
19	1140	75.3
20	1200	72.0
21	1260	70.0
22	1320	68.2
23	1380	66.5
24	1440	65.0

Attachment 2

PERMEATION TEST RESULTS

December 2000

Diurnal Cycles* (# 24 hr cycles)	Container Identification	Container Mfg.	Container Mfg. Identification	Barrier Treatment	Treatment Level	Container Volume	Test Dates	Fuel Type	Avg. Loss (g/gal/day)
10	W5L3-1	Wedco	WCA-525	Fluorination	3	5 gallon	12/8 - 12/21	CERT	0.07
10	W5L3-2	Wedco	WCA-525	Fluorination	3	5 gallon	12/8 - 12/21	CERT	0.06
10	W5L3-3	Wedco	WCA-525	Fluorination	3	5 gallon	12/8 - 12/21	CERT	0.10
10	W5L3-4	Wedco	WCA-525	Fluorination	3	5 gallon	12/8 - 12/21	CERT	0.06
10	W5L3-5	Wedco	WCA-525	Fluorination	3	5 gallon	12/8 - 12/21	CERT	0.09
Average =									0.08
10	W25L5-1	Wedco	WCA-225	Fluorination	5	2.5 gallon	12/8 - 12/21	CERT	0.04
10	W25L5-2	Wedco	WCA-225	Fluorination	5	2.5 gallon	12/8 - 12/21	CERT	0.05
10	W25L5-3	Wedco	WCA-225	Fluorination	5	2.5 gallon	12/8 - 12/21	CERT	0.04
10	W25L5-4	Wedco	WCA-225	Fluorination	5	2.5 gallon	12/8 - 12/21	CERT	0.07
10	W25L5-5	Wedco	WCA-225	Fluorination	5	2.5 gallon	12/8 - 12/21	CERT	0.07
Average =									0.06

*The results are based on 10 diurnal cycles, although 13 were performed. The first 3 days were not included because of high variability.