

California Environmental Protection Agency



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

Engineering and Certification Branch
Monitoring and Laboratory Division

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Permeation Rates of Blitz Fluorinated High Density Polyethylene Portable Fuel Containers

Introduction

The California Air Resources Board (CARB) staff tested several Blitz High-Density Polyethylene (HDPE) portable fuel containers (containers) to determine average permeation rates. Blitz submitted five 2 gallon and five 5 gallon portable fuel containers to the CARB staff for evaluation. All the containers were treated at level 3 fluorination. Containers were preconditioned with commercial pump fuel with MTBE, 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 August 2001.

Test Protocol

Blitz submitted a total of 10 containers for evaluation in July 2001. Prior to preconditioning, each container was subjected to the durability test procedure as required by Test Method 513. All containers tested underwent a preconditioning process consisting of filling each to its nominal capacity with commercial pump fuel and allowing them to soak at ambient temperature and pressure for a period of not less than four weeks. During preconditioning the containers were stored in flameproof cabinets located at the CARB test facility in El Monte. After a minimum of four weeks of ambient preconditioning, the containers were emptied; dried with compressed 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 of which can be found at the following URL:

<http://www.arb.ca.gov/regact/spillcon/spillcon.htm>

Weight loss is used to determine relative permeation rates. Depending upon their nominal capacity, sealed containers were weighed using either a 16,000 gram or 6,200 gram balance with sensitivities of ± 0.1 and ± 0.01 grams, respectively. Immediately prior to their placement in a Sealed Housing for Evaporative Determination (SHED), each container was weighed and their initial weight recorded on a field data sheet. The containers were then placed in a SHED and subjected to consecutive 24-hour variable temperature profiles (see Table 1). This profile is considered our diurnal cycle (recurring every day). Containers were post weighed after each 24-hour diurnal cycle and the daily weight losses were then calculated from the difference between the initial and final weights. This process was repeated for each container until the weight loss of five consecutive 24-hour cycles displayed a standard deviation of 0.25 grams.

After sufficient weight loss data were collected, the containers were then opened, the contents drained, and the interior of the container dried with compressed air. The tare weights of each container were recorded and used to calculate the average permeation rates.

Results

Cumulative weight losses were determined for each container as a function of time. The containers underwent a total of nine 24-hour diurnal cycles, but results were calculated using only five cycles. The first three days of test data are generally not used in determining individual per container permeation rates due to high variability. It should be noted that due to a malfunction in the SHED operating system, five consecutive 24-hour diurnal cycles were not used in determining relative permeation rates as required by CARB Test Method 513. Staff was not able to verify the temperature profile for the cycle beginning on September 1, 2001. Therefore, relative permeation rates were calculated based on data from tests number 1, 2, 3, 4, and 7. A summary of all test results can be found in Table 2. Additionally, data from all tests are attached.

The average permeation rate for the 5 gallon Blitz container designated 7-1-102 was determined to be 0.31 grams/gallon/day. This rate is based on data averaged from tests of five consecutive 24-hour diurnal cycles.

The average permeation rate for the 5 gallon Blitz container designated 7-2-102 was determined to be 0.45 grams/gallon/day. This rate is based on data averaged from tests of five consecutive 24-hour diurnal cycles.

The average permeation rate for the 5 gallon Blitz container designated 7-3-103 was determined to be 0.32 grams/gallon/day. This rate is based on data averaged from tests of five consecutive 24-hour diurnal cycles.

The average permeation rate for the 5 gallon Blitz container designated 7-4-103 was determined to be 0.35 grams/gallon/day. This rate is based on data averaged from tests of five consecutive 24-hour diurnal cycles.

The average permeation rate for the 5 gallon Blitz container designated 7-5-104 was determined to be 0.46 grams/gallon/day. This rate is based on data averaged from tests of five consecutive 24-hour diurnal cycles.

The average permeation rate for the 2 gallon Blitz container designated 7-6-105 was determined to be 0.14 grams/gallon/day. This rate is based on data averaged from tests of five consecutive 24-hour diurnal cycles.

The average permeation rate for the 2 gallon Blitz container designated 7-7-105 was determined to be 0.16 grams/gallon/day. This rate is based on data averaged from tests of five consecutive 24-hour diurnal cycles.

The average permeation rate for the 2 gallon Blitz container designated 7-8-106 was determined to be 0.38 grams/gallon/day. This rate is based on data averaged from tests of five consecutive 24-hour diurnal cycles.

The average permeation rate for the 2 gallon Blitz container designated 7-9-106 was determined to be 0.28 grams/gallon/day. This rate is based on data averaged from tests of five consecutive 24-hour diurnal cycles.

The average permeation rate for the 2 gallon Blitz container designated 7-10-106 was determined to be 0.17 grams/gallon/day. This rate is based on data averaged from tests of five consecutive 24-hour diurnal cycles.

Table 1.

1 Day / 24 Hour / 1440 Minute Variable Temperature Profile

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

Table 2.

PERMEATION TEST RESULTS

July 2001

Tank Label	Mfg.	Tank Volume	Treatment Type	Test Dates	Fuel Type	Avg. Loss (g/gal/day)
7-1-102	Blitz	5 gallon	Fluorination	8/28 - 9/4	CERT	0.31
7-2-102	Blitz	5 gallon	Fluorination	8/28 - 9/4	CERT	0.45
7-3-103	Blitz	5 gallon	Fluorination	8/28 - 9/4	CERT	0.32
7-4-103	Blitz	5 gallon	Fluorination	8/28 - 9/4	CERT	0.35
7-5-104	Blitz	5 gallon	Fluorination	8/28 - 9/4	CERT	0.46
					Average	0.38
7-6-105	Blitz	2 gallon	Fluorination	8/28 - 9/4	CERT	0.14
7-7-105	Blitz	2 gallon	Fluorination	8/28 - 9/4	CERT	0.16
7-8-106	Blitz	2 gallon	Fluorination	8/28 - 9/4	CERT	0.38
7-9-106	Blitz	2 gallon	Fluorination	8/28 - 9/4	CERT	0.28
7-10-106	Blitz	2 gallon	Fluorination	8/28 - 9/4	CERT	0.17
					Average	0.23