Organic Gas Speciation Profiles for
E6 Summer Liquid Gasoline Fuel (OG681) &
E6 Winter Liquid Gasoline Fuel (OG682)

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1 Introduction

The current CARB organic gas speciation profile for liquid gasoline is OG660 (Liquid Gasoline 1996 SSD Ethanol 2.0% oxygen, MTBE phased out) [1]. This profile was created in 1999 for gasoline fuel that contains 6%vol ethanol (i.e. 2.0%wt oxygen) by adjusting the composite profile for California Reformulated Gasoline (CaRFG) blended with 11%vol MTBE [2]. OG660 is applied to categories of *vehicle refueling spillage*, *on-road gasoline vehicle hot soak* and *running losses* for 2004 and later years.

In 2005 and 2006, CARB conducted the seventeenth Vehicle Surveillance Program (VSP 17). The purpose of VSP 17 was to measure criteria pollutant emissions and speciated TOG emissions for vehicles representative of the California vehicle fleet after the transition to ethanol-containing fuels. Liquid fuel samples were also collected and analyzed in the program. A total of 45 in-use vehicles were randomly selected and a fuel sample was taken from each vehicle as received in the project. Twenty-five summer-grade CaRFG Phase 3 fuels and twenty winter-grade CaRFG Phase 3 fuels were collected for speciation testing. To save cost, MLD staff grouped the fuel samples into 2 composite summer fuel samples and 2 composite winter fuel samples. Detailed hydrocarbon analyses (DHA) of the 4 composite fuel samples were performed by a contractor, Core Laboratories (8210 Mosley Rd., Houston, TX 77075). Based on the test results, two new speciation profiles were developed for regular grade E6 gasoline: OG681 for summer-grade fuel and OG682 for winter-grade fuel.

2 Methodology

In the VSP-17 DHA tests, over two hundred hydrocarbon compounds were detected in the liquid fuel samples by using ASTM D-6733 (*Standard Test Method for Determination of Individual Components in Spark Ignition Engine Fuels by 50-Metre Capillary High Resolution Gas Chromatography*). The final profile OG681 is obtained by averaging the test results of the 2 composite summer fuel samples; and the final OG682 is obtained by averaging the test results of the 2 composite winter fuel samples.

Among the species identified by DHA tests, nineteen of them are not included in the existing CARB chemical database, i.e. the CEIDARS POLLUTANT table. Thus, new CARB SAROAD codes are generated for these species as follows (Table 1):

Table 1. New CARB SAROAD codes to be added to the CEIDARS POLLUTANT table

CARB SAROAD	*CAS*	*Chemical Name*	*Formula*	*Molecular Weight*
43164		1,4-dimethyl-2-ethylcyclohexane	C10H20	140.27
43165	7058-05-1	1-ethyl-2,3-dimethylcyclohexane	C10H20	140.27
43166	762-62-9	4,4-dimethyl-1-pentene	C7H14	98.19
43167	15869-86-0	4-ethyloctane	C10H22	142.28
43169	1759-81-5	4-methylcyclopentene	C6H10	82.14
43170	1795-26-2	cis,trans-1,3,5-trimethylcyclohexane	C9H18	126.24
43171		cis-1,3-diethylcyclohexane	C10H20	140.27
43172	1574-41-0	cis-1,3-pentadiene	C5H8	68.12
43173		cis-1,4-diethylcyclohexane	C10H20	140.27
43175	42806-75-7	cis-1-methyl-3-propylcyclohexane	C10H20	140.27
43176		cis-1-methyl-4-propylcyclohexane	C10H20	140.27
43177	7642-15-1	cis-4-octene	C8H16	112.21
43179	4850-32-2	sec-butylcyclopentane	C9H18	126.24
43180		trans,trans-1,2,3-trimethylcyclohexane	C9H18	126.24
43181		trans-1,2-diethylcyclohexane	C10H20	140.27
43182	930-90-5	trans-1-ethyl-2-methylcyclopentane	C8H16	112.21
43184	34522-19-5	trans-1-methyl-3-propylcyclohexane	C10H20	140.27
43186		trans-1-methyl-4-ter-butylcyclohexane	C11H22	154.29
43187	281-23-2	tricyclodecane	C10H16	136.24

3 Results

The details of the two new profiles, OG681 (E6 Summer) and OG682 (E6 Winter), are tabulated in Appendix 1. The most abundant species in these two profiles include: toluene (about 8%), isopentane (about 7%), and ethanol (about 6%). The weight percentages of most species are very similar in these two profiles. A comparison of the summer fuel profile with the winter fuel profile (OG681 vs. OG682) is discussed below in Section 3.1. Additionally, the E6 summer fuel profile and the recently developed E10 summer fuel profile are compared (OG681 vs. OG690) in Section 3.2 to better understand the composition changes from E6 to E10 fuel. It should be noted that both of the new profiles OG681 and OG690 were generated from testing data; however, the current E6 profile OG660 was not based on measurements. Therefore, the new E6 profile is compared with the current E6 profile (O G681 vs. OG660) in Section 3.3. The results show if there are significant differences between the profiles that is based on measurements versus estimation.

3.1 New E6 Summer Fuel Profile vs. New E6 Winter Fuel Profile (OG681 vs. OG682)

A comparison by compound carbon number shows that the summer fuel (OG681) has 3.7% less C4-compounds, but 3.8% more C8-compounds than the winter fuel (OG682) (Figure 1). Figure 2 indicates that the summer fuel (OG681) has 4.0% less paraffins, but 4.7% more isoparaffins, compared to the winter fuel (OG682).

A comparison of the major components in OG681 and OG682 shows that summer fuel consists of about 3.0% less butane but 2.8% more 2,2,4-trimethylpentane than winter fuel (Figure 3). This divergence is due to the different Reid Vapor Pressures (RVP) of the two fuels. California's standards mandate summer gasoline with RVP 7.0 PSI or lower to limit ground-level ozone formation [3]. Fuels with higher RVP evaporate more easily than those with lower RVP. Butane as a species with high volatility is typically added to the winter-grade fuel blend to increase RVP. The weight percentages of most other species are similar in the two profiles.

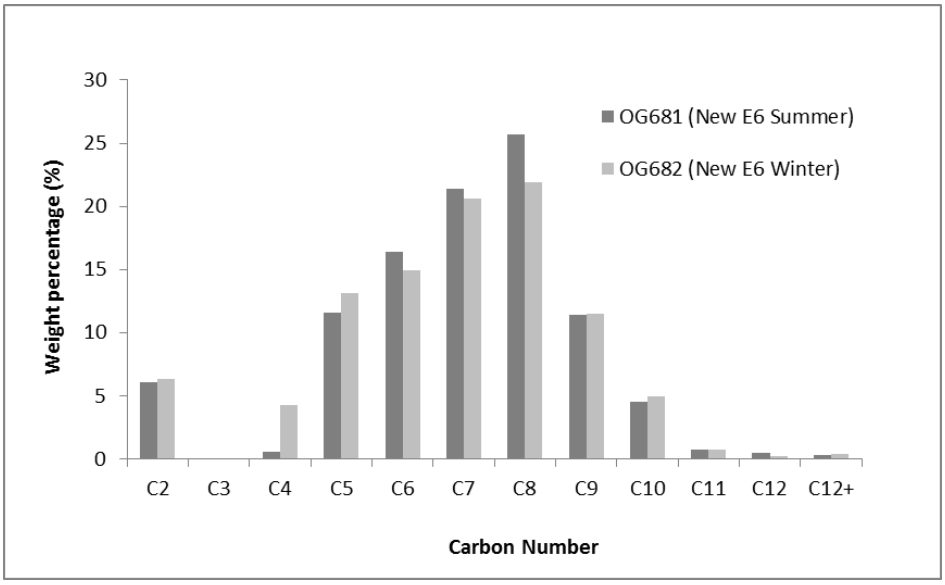

Figure 1. Speciation profile comparison between OG681 and OG682 by carbon number

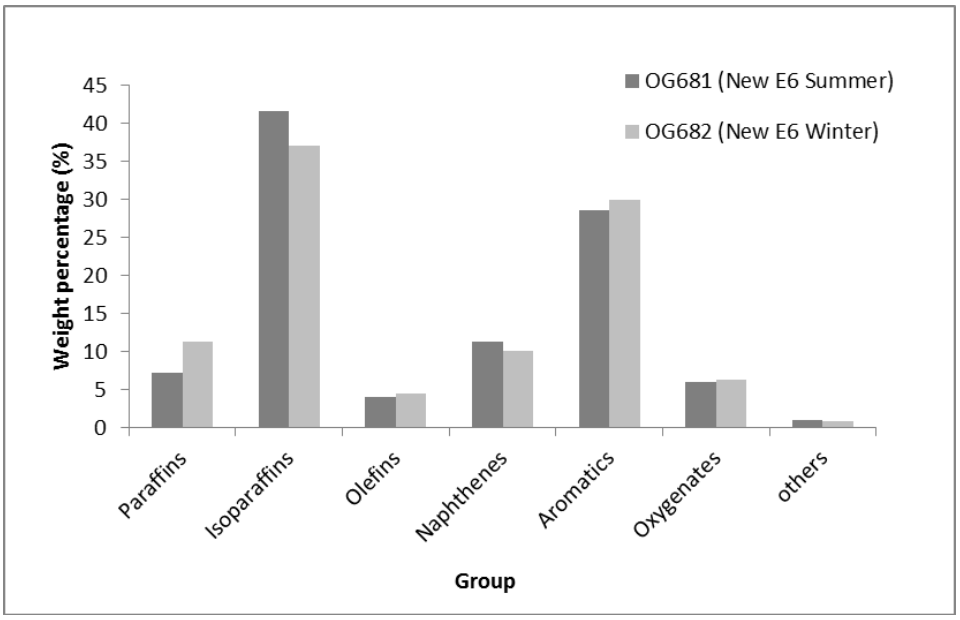

Figure 2. Speciation profile comparison between OG681 and OG682 by compound group

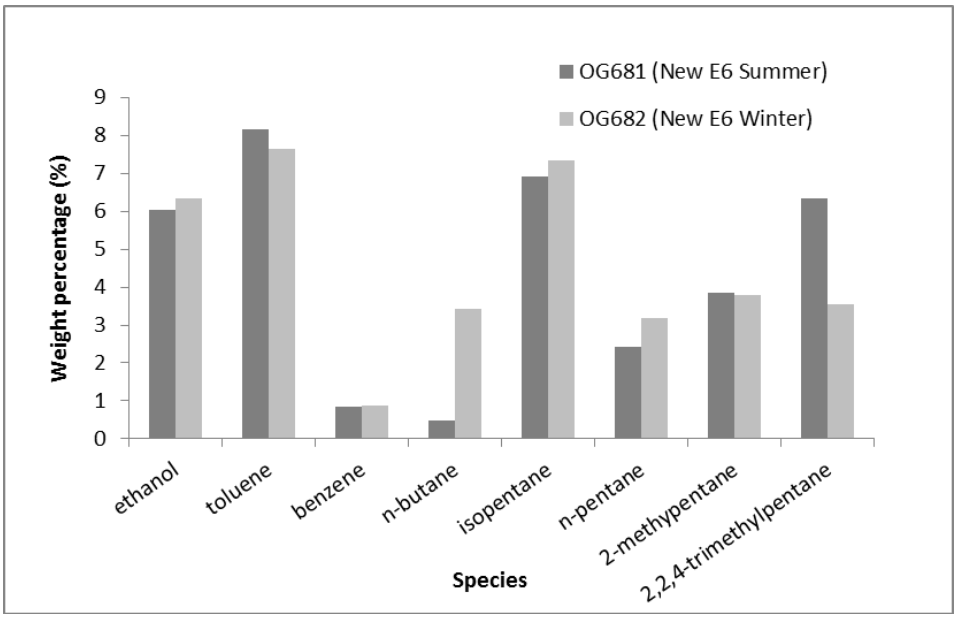

Figure 3. Comparison of selected species between OG681 and OG682

3.2 New E6 Summer Profile vs. New E10 Summer Profile (OG681 vs. OG690)

A carbon number comparison shows that E6 summer fuel (OG681) has 4.0% less C2-species than E10 summer fuel (OG690). This is due to the increase in ethanol content from 6% to 10%. E6 summer fuel also has a higher concentration of C5 to C9-compounds than the E10 summer fuel (Figure 4). A comparison by compound group shows that the E6 fuel has 4.1% less oxygenates than the E10 fuel mainly due to the ethanol change, but the isoparaffins and aromatics compounds are 5.1% and 3.5% greater in the E6 than the E10 fuel (Figure 5).

Comparing the major gasoline components show that the weight fractions of toluene, n-pentane, isopentane, 2-methylpentane and 2,2,4-trimethylpentane in the E6 summer fuel (OG681) are all greater than in the E10 summer fuel (OG690), ethanol is an exception (Figure 6).

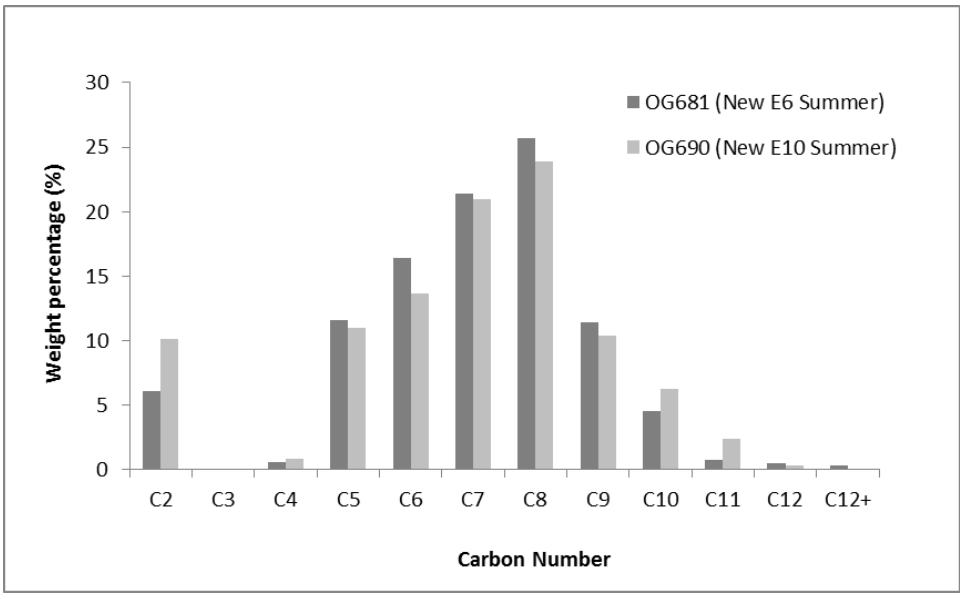

Figure 4. Speciation profile comparison between OG681 and OG690 by carbon number

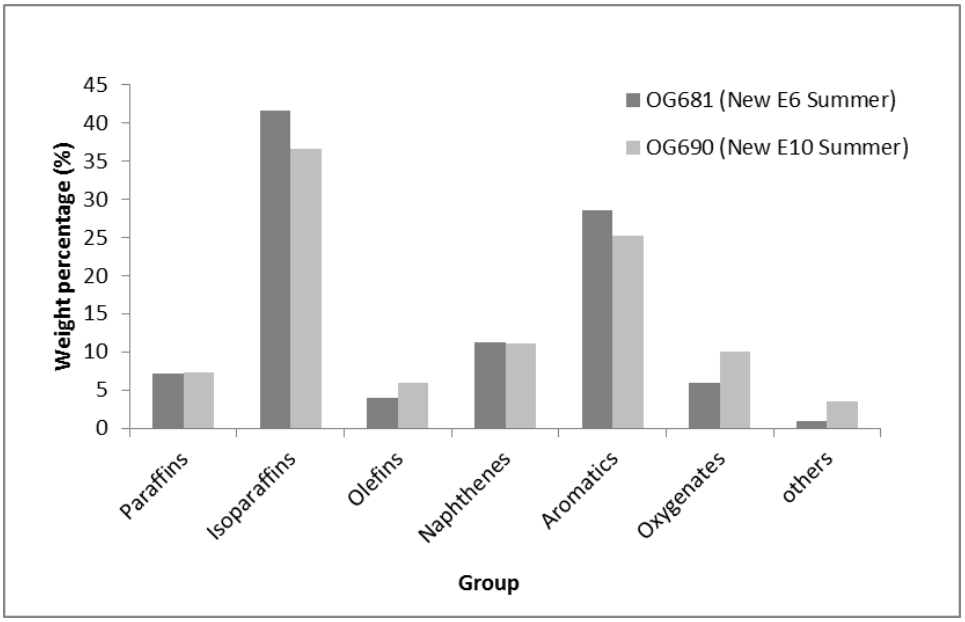

Figure 5. Speciation profile comparison between OG681 and OG690 by compound group

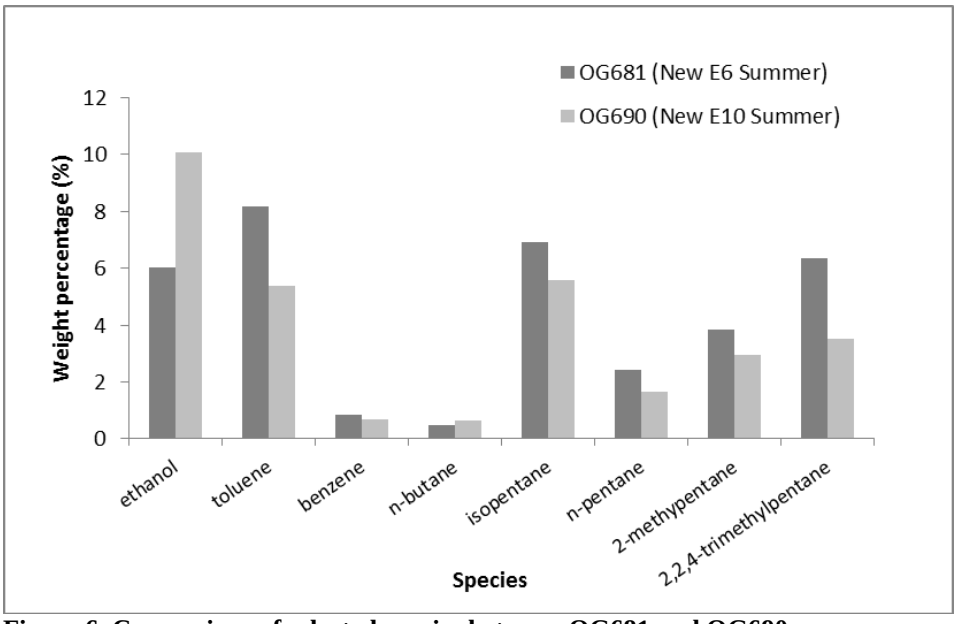

Figure 6. Comparison of selected species between OG681 and OG690

3.3 New E6 Summer Profile vs. Current E6 Profile (OG681 vs. OG660)

The new E6 summer fuel profile (OG681) is based on measurement data from commercial summer fuels; while the current CARB E6 fuel profile (OG660) was created by adjusting the MTBE-containing profile more than a decade ago. Therefore, the gasoline fuel is expected to be better characterized by OG681 (which is developed using real testing data) rather than the estimated OG660. The comparisons between these two profiles are plotted in Figures 7-9. Compared to the current profile (OG660), the new profile (OG681) has higher percentages of C5-, C6-, C9 and C10-compounds, but lower percentages of C7- and C8-compounds (Figure 7). The new profile (OG681) consists of more aromatics but less isoparaffins (Figure 8). The analysis of the major liquid gasoline components exhibits that there are 3.1% more toluene but 3.3% less 2,2,4-trimethylpentane in the new profile (OG681) than in the current profile (OG660) (Figure 9).

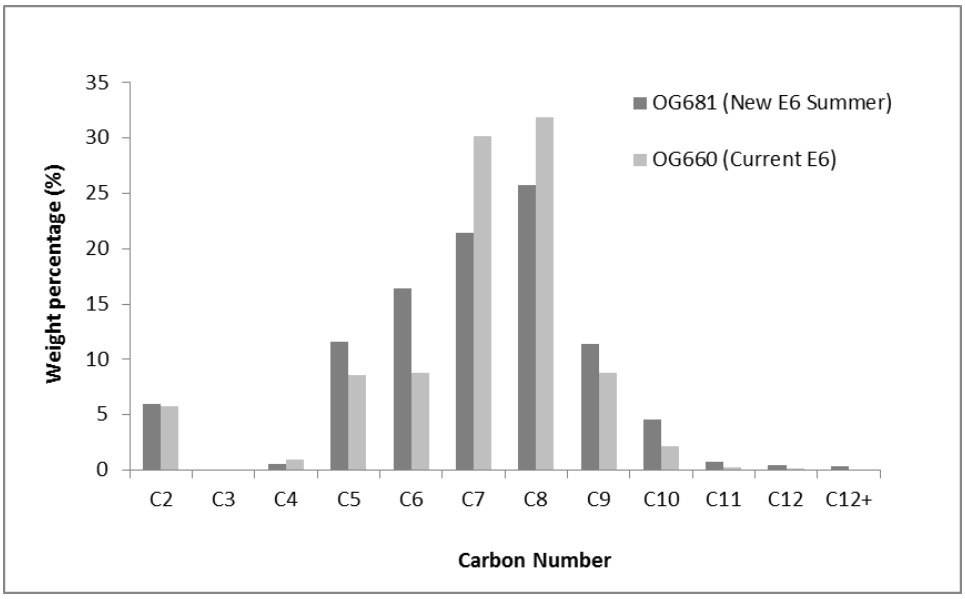

Figure 7. Speciation profile comparison between OG681 and OG660 by carbon number

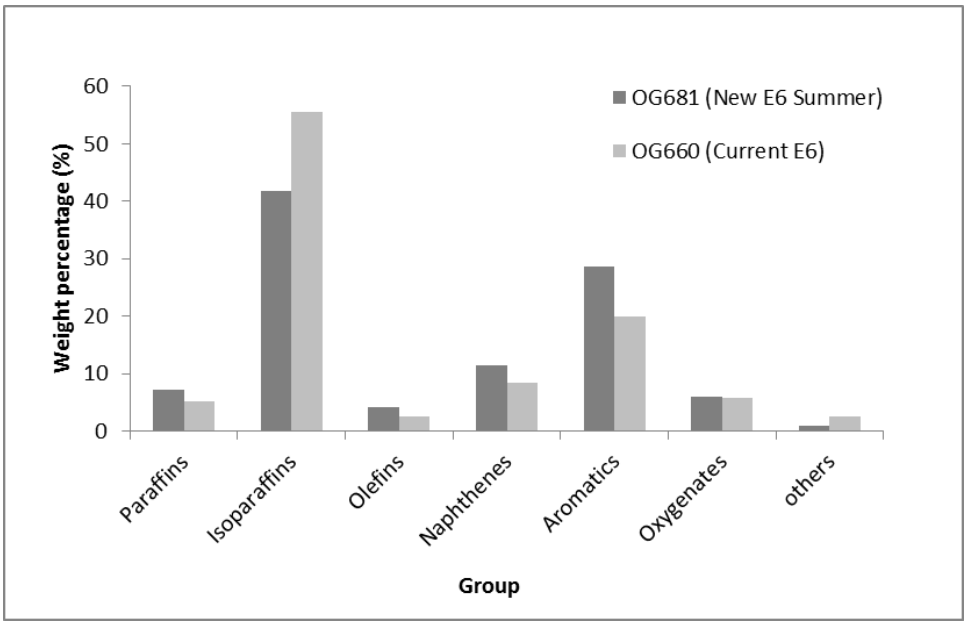

Figure 8. Speciation profile comparison between OG681 and OG660 by compound group

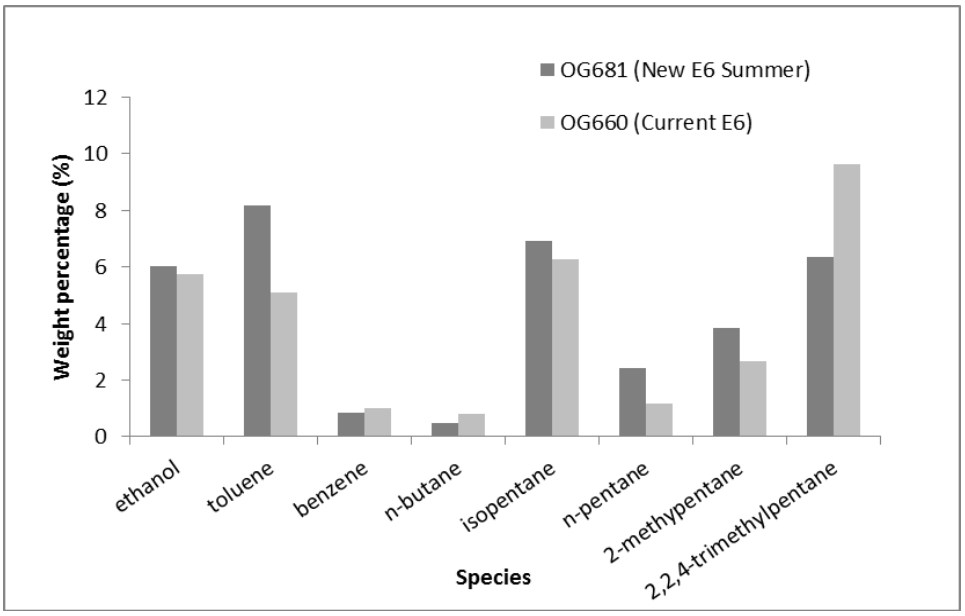

Figure 9. Comparison of selected species between OG681 and OG660

The ratio of TOG/THC (total organic gases/total hydrocarbon) is 1.04 for OG681 and OG682. This ratio can be used to convert THC emission mass to actual weight TOG. The ROG/TOG ratio is 1.00 for both profiles.

4 Estimated Impacts of the Profile Update on the Emission Inventory

The newly-developed profiles, OG681 and OG682, will replace the current profile OG660 for categories associated with on-road gasoline vehicle hot soak emissions, on-road gasoline vehicle running loss evaporative, and spillage of vehicle refueling at gasoline dispensing facilities for years 2004 to 2009 as E6 fuel was in use during this time period. The summer-grade profile OG681 will be used during the months of RVP regulatory control periods; while the winter-grade profile OG682 will be used for other months of the year. It should be noted that the control period varies for different air basins [3]. The related EIC/SCC codes for these emission processes are summarized in Appendix 2.

Based on the 2009 Almanac, statewide annual average TOG emissions for calendar year 2008 from the emission categories to which these profiles will be assigned are 206.11 tons/day, which is 2.48% of the total statewide TOG emissions [4]. Based on the ROG/TOG ratios derived from the new profiles OG681 and OG682, the statewide 2008 ROG will be 206.11 tons/day, which is 0.76% higher than the ROG estimated based on the current profile OG660 (ROG/TOG=0.9924); however, the replacement of OG660 with the new summer (OG681) and winter profiles (OG682) will cause a 14.6% and 11.2% decrease in benzene emissions but 59.9% and 49.8% increase in toluene emissions, respectively (Table 2). The ozone forming potential (OFP) calculated based on the SAPRC07 mechanism [5] is 3.05 for OG681 and 3.16 for OG682; while the one for the current profile OG660 is 2.46.

Table 2. Changes on emissions of organic gas species for liquid gasoline related categories (2008)
(a) OG681 (New E6 Summer) vs. OG660 (Current E6)

Statewide Annual Ave. Emissions		*OG660 Current E6 (tons/day)*	*OG681 New E6 Summer (tons/day)*	*Change*	
				Emission (tons/day)	*Percentage*
ROG		204.54	206.11	+1.57	+0.8%
Ozone forming potential, MIR (g O3/g ORG)		2.46	3.05	+0.59	+24.0%
Toxics	Benzene	2.06	1.76	-0.30	-14.6%
	Toluene	10.52	16.82	+6.30	+59.9%

(b) OG682 (New E6 Winter) vs. OG660 (Current E6)

Statewide Annual Ave. Emissions		*OG660 Current E6 (tons/day)*	*OG682 New E6 Winter (tons/day)*	*Change*	
				Emission (tons/day)	*Percentage*
ROG		204.54	206.11	+1.57	+0.8%
Ozone forming potential, MIR (g O3/g ORG)		2.46	3.16	+0.70	+28.5%
Toxics	Benzene	2.06	1.83	-0.23	-11.2%
	Toluene	10.52	15.76	+5.24	+49.8%

5 Version Control

This section will be completed after management approval and after the CEIDARS FRACTION table and ORGPROFILE table are updated. Version information from CEIDARS FRACTION table will be copied here.

References:

1. *California Air Resources Board Main Speciation Profiles*, 2013, California Air Resources Board.
2. Croes, B., et al., *Air Quality Impacts of the Use of Ethanol in California Reformulated Gasoline*, 1999, California Air Resources Board.
3. *Title 13, California Code of Regulations, The California Reformulated Gasoline Regulations, Sections 2250-2273.5*.
4. *CEPAM*, 2012, California Air Resources Board.
5. *Titel 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 8.6, Article 1. Maximum Incremental Reactivity Values, Sections 94700-94701*.

Appendix 1. OG Speciation Profiles for E6 Summer and Winter Gasoline Fuels

Species Name	*SAROAD*	*Weight Percentage, %*	
		OG681 *E6 Summer Gasoline*	*OG682* *E6 Winter Gasoline*
(1-methylpropyl)benzene	45234	0.01	
(2-methylpropyl)benzene	45235	0.10	0.08
1,1,3-trimethylcyclohexane	91064	0.115	0.10
1,1,3-trimethylcyclopentane	91030	0.165	0.165
1,1-dimethylcyclohexane	91041	0.02	0.02
1,1-dimethylcyclopentane	99098	0.065	0.075
1,2,3,4-tetramethylbenzene	91109		0.075
1,2,3,5-tetramethylbenzene	91104	0.205	0.25
1,2,3-trimethylbenzene	45225	0.45	0.52
1,2,4,5-tetramethylbenzene	91103	0.145	0.175
1,2,4-trimethylbenzene	45208	2.31	2.54
1,2-dimethyl-3-ethylbenzene	45254	0.09	0.09
1,2-dimethyl-4-ethylbenzene	45252	0.28	0.285
1,3,5-trimethylbenzene	45207	0.805	0.855
1,3-cyclopentadiene	90026	0.005	0.005
1,3-diethylbenzene	45113	0.04	0.02
1,3-dimethyl-2-ethylbenzene	45253	0.11	0.06
1,3-dimethyl-4-ethylbenzene	45251	0.35	0.42
1,3-dimethyl-5-ethylbenzene	45257	0.03	0.17
1,4-diethylbenzene	45114	0.255	0.30
1,4-dimethyl-2-ethylbenzene	45250	0.205	0.24
1,4-dimethyl-2-ethylcyclohexane	43164	0.09	0.05
1-butene	43213	0.01	0.065
1-ethyl-2,3-dimethylcyclohexane	43165	0.02	0.02
1-hexene	43245	0.055	0.06
1-methyl-2-ethylbenzene	99915	0.545	0.61
1-methyl-2-isopropylbenzene	91096	0.04	0.035
1-methyl-2-n-propylbenzene	98178	0.12	0.125
1-methyl-3-ethylbenzene	99912	1.395	1.555
1-methyl-3-isopropylbenzene	98153	0.03	0.025
1-methyl-3-n-propylbenzene	98152		0.145
1-methyl-4-ethylbenzene	99914	0.635	0.695
1-methyl-4-isopropylbenzene	91094	0.01	0.015
1-methyl-4-n-propylbenzene	98182	0.395	0.405
1-methylcyclopentene	92000	0.005	
1-methylnaphthalene	91124	0.06	0.07
1-pentene	43224	0.15	0.18
2,2,3-trimethylbutane	43160	0.065	0.03
2,2,4-trimethylpentane	43276	6.335	3.54
2,2,5-trimethylhexane	98033	1.05	0.535
2,2-dimethylbutane	43291	0.655	0.71
2,2-dimethyloctane	98175	0.065	0.05
2,2-dimethylpentane	90042	0.125	1.425
2,2-dimethylpropane	98130	0.01	0.01
2,3,3-trimethyl-1-butene	91002	0.01	0.025
2,3,3-trimethylpentane	43280	0.01	0.03
2,3,4-trimethylpentane	43279	2.34	1.455

Species Name	*SAROAD*	*Weight Percentage, %*	
		OG681 *E6 Summer Gasoline*	*OG682* *E6 Winter Gasoline*
2,3-dimethyl-1-butene	43234	0.03	0.03
2,3-dimethylbutane	98001	1.675	1.32
2,3-dimethylheptane	98145	0.015	0.015
2,3-dimethylhexane	98139	0.745	0.545
2,3-dimethylpentane	43274	2.685	1.885
2,4-dimethyl-1-pentene	90063	0.01	0.01
2,4-dimethylheptane	98142	0.16	0.16
2,4-dimethylhexane	43277	0.835	0.61
2,4-dimethyloctane	98149	0.065	0.075
2,4-dimethylpentane	43271	1.65	0.61
2,5-dimethylheptane	98143	0.27	0.255
2,5-dimethylhexane	43278	1.08	0.70
2,5-dimethyloctane	98176	0.035	0.035
2,6-dimethylheptane	98157	0.025	0.025
2,6-dimethyloctane	98177	0.115	0.105
2-methyl-1-butene	43225	0.30	0.345
2-methyl-1-pentene	98040	0.14	0.14
2-methyl-2-butene	43228	0.635	0.715
2-methyl-2-pentene	98004	0.19	0.19
2-methyl-3-ethylpentane	91034	0.045	0.04
2-methylheptane	98140	0.715	0.79
2-methylhexane	43275	1.77	1.815
2-methylnaphthalene	91123	0.125	0.155
2-methylnonane	90047	0.355	0.19
2-methyloctane	98146	0.26	0.295
2-methylpentane	43229	3.86	3.785
2-methylundecane	99111	0.025	0.015
3,3-dimethylhexane	98171	0.05	0.055
3,3-dimethylpentane	90040	0.12	0.125
3,4-dimethylheptane	91069	0.07	0.08
3,4-dimethylhexane	98150	0.085	
3,5-dimethylheptane	98144	0.045	0.05
3,6-dimethyloctane	91086	0.025	0.015
3-ethyl-2-pentene	98007	0.02	0.02
3-ethylheptane	91071	0.075	0.085
3-ethyloctane	91089	0.025	0.03
3-ethylpentane	43300	0.18	0.19
3-methyl-1-butene	43223	0.04	0.05
3-methyl-1-pentene	43211	0.04	0.04
3-methyl-cis-2-hexene	90029	0.11	0.055
3-methyl-cis-2-pentene	98163	0.165	0.06
3-methyl-cis-3-hexene	91024	0.055	0.06
3-methylcyclopentene	43272	0.22	0.225
3-methyldecane	99115	0.035	0.04
3-methylheptane	43298	0.975	1.08
3-methylhexane	43295	1.84	1.915
3-methylnonane	91090	0.125	0.14
3-methyloctane	98172	0.315	0.35
3-methylpentane	43230	2.355	2.305

Species Name	*SAROAD*	*Weight Percentage, %*	
		OG681 *E6 Summer Gasoline*	*OG682* *E6 Winter Gasoline*
3-methyl-trans-2-pentene	43270	0.185	0.16
3-methylundecane	99094	0.075	0.095
4,4-dimethyl-1-pentene	43166	0.05	0.105
4-ethylheptane	91070	0.065	0.095
4-ethyloctane	43167	0.005	
4-methyl-1-pentene	98135	0.03	0.03
4-methylcyclopentene	43169	0.125	0.13
4-methyldecane	99102	0.05	0.045
4-methylheptane	43297	0.375	0.465
4-methylindan	91107	0.16	0.215
4-methylnonane	99122	0.075	0.085
4-methyloctane	98173	0.205	0.235
4-methyl-trans-2-hexene	90031	0.055	0.075
4-methylundecane	99103	0.035	0.035
5-methyldecane	99116	0.078	0.08
5-methylindan	91106	0.135	0.175
5-methylnonane	91088	0.045	0.045
5-methylundecane	99097	0.065	0.04
benzene	45201	0.855	0.89
c10 cycloalkanes	98070	0.015	
c11 aromatics	45505	0.205	0.24
c8 olefins	43290	0.045	0.055
c9 cycloalkanes	43117	0.135	0.14
cis,cis-1,2,4-trimethylcyclohexane	99054	0.025	0.025
cis,trans-1,2,3-trimethylcyclohexane	99128	0.045	0.055
cis,trans-1,2,4-trimethylcyclohexane	99079	0.05	
cis,trans-1,3,5-trimethylcyclohexane	43170	0.115	0.105
cis-1,2-dimethylcyclohexane	91055	0.01	0.01
cis-1,3-diethylcyclohexane	43171	0.055	0.06
cis-1,3-dimethylcyclohexane	98180	0.27	0.27
cis-1,3-dimethylcyclopentane	91018	0.58	0.58
cis-1,3-pentadiene	43172	0.005	0.005
cis-1,4-diethylcyclohexane	43173	0.04	0.02
cis-1,4-dimethylcyclohexane	91051	0.0575	0.0575
cis-1,trans-2,4-trimethylcyclopentane	91031	0.09	0.09
cis-1-ethyl-2-methylcyclohexane	99109	0.02	
cis-1-ethyl-2-methylcyclopentane	99093	0.15	0.085
cis-1-ethyl-3-methylcyclohexane	99126	0.08	0.075
cis-1-ethyl-3-methylcyclopentane	99071	0.14	0.145
cis-1-methyl-3-propylcyclohexane	43175	0.10	0.09
cis-1-methyl-4-propylcyclohexane	43176	0.065	0.04
cis-2-butene	43217	0.035	0.085
cis-2-heptene	91028	0.055	0.06
cis-2-hexene	98035	0.065	0.03
cis-2-octene	43266	0.025	0.035
cis-2-pentene	43227	0.24	0.28
cis-3-heptene	91025	0.11	0.12
cis-3-hexene	98003	0.09	0.09
cis-4-octene	43177		0.005

Species Name	*SAROAD*	*Weight Percentage, %*	
		OG681 *E6 Summer Gasoline*	*OG682* *E6 Winter Gasoline*
cyclohexane	43248	1.1	1.135
cyclohexene	43273	0.03	0.03
cyclopentane	43242	0.345	0.375
cyclopentene	43292	0.105	0.11
ethanol	43302	6.03	6.335
ethylbenzene	45203	1.38	1.44
ethylcyclohexane	43288	0.235	0.23
ethylcyclopentane	98057	0.28	0.285
hexadecane	43281		0.005
indan	98044	0.245	0.285
isobutane	43214	0.05	0.615
isobutylcyclopentane	91077	0.21	0.165
isomers of pentadecane	43114	0.075	0.055
isomers of tetradecane	43113	0.02	0.025
isomers of tridecane	43112	0.235	0.265
isopentane	98132	6.905	7.35
isoprene	43243	0.01	0.01
isopropylbenzene	98043	0.08	0.08
isopropylcyclohexane	90120	0.08	0.075
isopropylcyclopentane	43178	0.095	0.085
methylcyclohexane	43261	1.27	1.22
methylcyclopentane	43262	2.495	1.585
m-xylene	45205	3.93	4.10
naphthalene	98046	0.155	0.195
n-butane	43212	0.48	3.43
n-butylbenzene	91098	0.285	0.34
n-butylcyclopentane	91085	0.115	0.10
n-decane	43238	0.16	0.165
n-dodecane	43255		0.045
n-heptane	43232	1.12	1.215
n-hexane	43231	1.995	1.995
n-nonane	43235	0.30	0.32
n-octane	43233	0.7175	0.7825
n-pentane	43220	2.42	3.175
n-pentylbenzene	45255	0.04	0.05
n-propylbenzene	45209	0.445	0.475
n-tridecane	43258		0.01
n-undecane	43241	0.085	0.075
o-xylene	45204	2.055	2.165
pentamethylbenzene	91122	0.025	0.025
propane	43204		0.035
propylcyclohexane	90119	0.115	0.12
propylcyclopentane	90116	0.11	0.10
p-xylene	45206	1.74	1.79
sec-butylcyclopentane	43179	0.04	0.025
toluene	45202	8.16	7.645
trans,cis-1,2,4-trimethylcyclohexane	99075	0.025	0.02
trans,trans-1,2,3-trimethylcyclohexane	43180	0.10	0.035
trans-1,2-cis-4-trimethylcyclopentane	43312	0.215	0.215

Species Name	*SAROAD*	*Weight Percentage, %*	
		OG681 *E6 Summer Gasoline*	*OG682* *E6 Winter Gasoline*
trans-1,2-diethylcyclohexane	43181	0.03	
trans-1,2-dimethylcyclohexane	91047	0.115	0.115
trans-1,2-dimethylcyclopentane	91021	0.45	0.47
trans-1,3-dimethylcyclohexane	98059	0.045	0.05
trans-1,3-dimethylcyclopentane	91019	0.515	0.515
trans-1,3-pentadiene	90100	0.01	0.01
trans-1,4-dimethylcyclohexane	98181	0.135	0.135
trans-1,cis-2,3-trimethylcyclopentane	91295	0.12	0.13
trans-1-ethyl-2-methylcyclohexane	99110	0.025	0.03
trans-1-ethyl-2-methylcyclopentane	43182	0.09	0.09
trans-1-ethyl-3-methylcyclohexane	99080	0.085	0.085
trans-1-ethyl-3-methylcyclopentane	99085		0.095
trans-1-ethyl-4-methylcyclohexane	99082	0.13	0.125
trans-1-methyl-2-propylcyclopentane	43183	0.145	0.08
trans-1-methyl-3-propylcyclohexane	43184	0.02	0.025
trans-1-methyl-4-ter-butylcyclohexane	43186	0.075	0.015
trans-2-butene	43216	0.03	0.08
trans-2-heptene	91026	0.04	0.045
trans-2-octene	43263	0.035	0.035
trans-2-pentene	43226	0.43	0.495
trans-3-heptene	98006	0.03	0.03
trans-3-hexene	98136	0.03	0.035
tricyclodecane	43187	0.02	0.01
unidentified	99999	0.937	0.905
Total		100.000	100.000

Appendix 2. EICs/SCCs to be associated with hot soak gasoline speciation profiles (hot soak, and running evaporation).

EIC/SCC	*Names*		
6	EMFAC/DTIM	GASOLINE	HOT SOAK
9	EMFAC/DTIM	GASOLINE	RUNNING EVAPORATIVES
206	EMFAC/DTIM	LIGHT/MEDIUM GASOLINE	HOT SOAK
209	EMFAC/DTIM	LIGHT/MEDIUM GASOLINE	RUNNING EVAPORATIVES
306	EMFAC/DTIM	HEAVY DUTY GASOLINE	HOT SOAK
309	EMFAC/DTIM	HEAVY DUTY GASOLINE	RUNNING EVAPORATIVES
46508	ON-ROAD VEHICLES	LIGHT DUTY PASSENGER	HOT SOAK
46565	GASOLINE DISP. FACIL	VEHICLE REFUELING	SPILLAGE
47506	ON-ROAD VEHICLES	LIGHT DUTY TRUCKS	HOT SOAK
48025	ON-ROAD VEHICLES	MOTORCYCLES	HOT SOAK
48041	ON-ROAD VEHICLES	HD GAS TRUCKS	HOT SOAK
54239	ON-ROAD VEHICLES	MEDIUM DUTY TRUCKS	HOT SOAK
82693	ON-ROAD VEHICLES	LIGHT DUTY PASSENGER	CAT HOT SOAK
82701	ON-ROAD VEHICLES	LIGHT DUTY PASSENGER	NON-CAT HOT SOAK
82719	ON-ROAD VEHICLES	LIGHT/MEDIUM TRUCKS	CAT HOT SOAK
82727	ON-ROAD VEHICLES	LIGHT/MEDIUM TRUCKS	NON-CAT HOT SOAK
83113	ON-ROAD VEHICLES	HEAVY GAS TRUCKS	NON-CAT HOT SOAK
83162	ON-ROAD VEHICLES	HEAVY GAS TRUCKS	CAT HOT SOAK
83386	ON-ROAD VEHICLES	LIGHT DUTY PASSENGER	CAT RUNNING EVAP
83394	ON-ROAD VEHICLES	LIGHT DUTY PASSENGER	NON-CAT RUNNING EVAP
83402	ON-ROAD VEHICLES	LIGHT/MEDIUM TRUCKS	CAT RUNNING EVAP
83410	ON-ROAD VEHICLES	LIGHT/MEDIUM TRUCKS	NON-CAT RUNNING EVAP
83428	ON-ROAD VEHICLES	HD GAS TRUCKS	NON-CAT RUNNING EVAP
83436	ON-ROAD VEHICLES	HD GAS TRUCKS	CAT RUNNING EVAP
83444	ON-ROAD VEHICLES	MOTORCYCLES	RUNNING EVAP
84087	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 1	NON-CAT RUNNING EVAP
84103	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 1	NON-CAT HOT SOAK
84178	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 1	CAT RUNNING EVAP
84194	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 1	CAT HOT SOAK
84293	ON-ROAD VEHICLES	MEDIUM TRUCKS	NON-CAT RUNNING EVAP
84319	ON-ROAD VEHICLES	MEDIUM TRUCKS	NON-CAT HOT SOAK
84384	ON-ROAD VEHICLES	MEDIUM TRUCKS	CAT RUNNING EVAP
84400	ON-ROAD VEHICLES	MEDIUM TRUCKS	CAT HOT SOAK
84459	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 1	NON-CAT RUNNING EVAP
84475	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 1	NON-CAT HOT SOAK
84533	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 1	CAT RUNNING EVAP
84558	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 1	CAT HOT SOAK
84608	ON-ROAD VEHICLES	MED HVY GAS TRUCKS	NON-CAT RUNNING EVAP
84624	ON-ROAD VEHICLES	MED HVY GAS TRUCKS	NON-CAT HOT SOAK
84681	ON-ROAD VEHICLES	MED HVY GAS TRUCKS	CAT RUNNING EVAP
84707	ON-ROAD VEHICLES	MED HVY GAS TRUCKS	CAT HOT SOAK
86157	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 2	NON-CAT RUNNING EVAP
86173	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 2	NON-CAT HOT SOAK
86249	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 2	CAT RUNNING EVAP

EIC/SCC	*Names*		
86264	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 2	CAT HOT SOAK
86462	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 2	NON-CAT RUNNING EVAP
86488	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 2	NON-CAT HOT SOAK
86561	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 2	CAT RUNNING EVAP
86587	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 2	CAT HOT SOAK
86694	ON-ROAD VEHICLES	HEAVY HEAVY DUTY GAS	NON-CAT RUNNING EVAP
86710	ON-ROAD VEHICLES	HEAVY HEAVY DUTY GAS	NON-CAT HOT SOAK
86793	ON-ROAD VEHICLES	HEAVY HEAVY DUTY GAS	CAT RUNNING EVAP
86819	ON-ROAD VEHICLES	HEAVY HEAVY DUTY GAS	CAT HOT SOAK
86983	ON-ROAD VEHICLES	MOTORCYCLES (MCY)	CAT RUNNING EVAP
87007	ON-ROAD VEHICLES	MOTORCYCLES (MCY)	CAT HOT SOAK
87072	ON-ROAD VEHICLES	HEAVY DUTY GAS URBAN	NON-CAT RUNNING EVAP
87098	ON-ROAD VEHICLES	HEAVY DUTY GAS URBAN	NON-CAT HOT SOAK
87163	ON-ROAD VEHICLES	HEAVY DUTY GAS URBAN	CAT RUNNING EVAP
87189	ON-ROAD VEHICLES	HEAVY DUTY GAS URBAN	CAT HOT SOAK
87247	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	NON-CAT RUNNING EVAP
87262	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	NON-CAT HOT SOAK
87338	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	CAT RUNNING EVAP
87353	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	CAT HOT SOAK
87452	ON-ROAD VEHICLES	MOTOR HOMES (MH)	NON-CAT RUNNING EVAP
87478	ON-ROAD VEHICLES	MOTOR HOMES (MH)	NON-CAT HOT SOAK
87544	ON-ROAD VEHICLES	MOTOR HOMES (MH)	CAT RUNNING EVAP
87569	ON-ROAD VEHICLES	MOTOR HOMES (MH)	CAT HOT SOAK
40600602	PETROLEUM MARKTNG	MISCELLANEOUS	SPILL LOSS W/O CNTLS
33038011000000	GASOLINE DISP. FACIL	VEHICLE REFUELING	SPILLAGE
71070811000000	ON-ROAD VEHICLES	LIGHT DUTY PASSENGER	NON-CAT RUNNING EVAP
71071211000000	ON-ROAD VEHICLES	LIGHT DUTY PASSENGER	NON-CAT HOT SOAK
71073611000000	ON-ROAD VEHICLES	LIGHT DUTY PASSENGER	CAT RUNNING EVAP
71074011000000	ON-ROAD VEHICLES	LIGHT DUTY PASSENGER	CAT HOT SOAK
72070811000000	ON-ROAD VEHICLES	LIGHT/MEDIUM TRUCKS	NON-CAT RUNNING EVAP
72071211000000	ON-ROAD VEHICLES	LIGHT/MEDIUM TRUCKS	NON-CAT HOT SOAK
72073611000000	ON-ROAD VEHICLES	LIGHT/MEDIUM TRUCKS	CAT RUNNING EVAP
72074011000000	ON-ROAD VEHICLES	LIGHT/MEDIUM TRUCKS	CAT HOT SOAK
72270811000000	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 1	NON-CAT RUNNING EVAP
72271211000000	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 1	NON-CAT HOT SOAK
72273611000000	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 1	CAT RUNNING EVAP
72274011000000	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 1	CAT HOT SOAK
72370811000000	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 2	NON-CAT RUNNING EVAP
72371211000000	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 2	NON-CAT HOT SOAK
72373611000000	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 2	CAT RUNNING EVAP
72374011000000	ON-ROAD VEHICLES	LT. DUTY TRUCKS - 2	CAT HOT SOAK
72470811000000	ON-ROAD VEHICLES	MEDIUM TRUCKS	NON-CAT RUNNING EVAP
72471211000000	ON-ROAD VEHICLES	MEDIUM TRUCKS	NON-CAT HOT SOAK
72473611000000	ON-ROAD VEHICLES	MEDIUM TRUCKS	CAT RUNNING EVAP
72474011000000	ON-ROAD VEHICLES	MEDIUM TRUCKS	CAT HOT SOAK
73070811000000	ON-ROAD VEHICLES	HD GAS TRUCKS	NON-CAT RUNNING EVAP
73071211000000	ON-ROAD VEHICLES	HEAVY GAS TRUCKS	NON-CAT HOT SOAK

EIC/SCC	*Names*		
73073611000000	ON-ROAD VEHICLES	HD GAS TRUCKS	CAT RUNNING EVAP
73074011000000	ON-ROAD VEHICLES	HEAVY GAS TRUCKS	CAT HOT SOAK
73270811000000	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 1	NON-CAT RUNNING EVAP
73271211000000	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 1	NON-CAT HOT SOAK
73273611000000	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 1	CAT RUNNING EVAP
73274011000000	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 1	CAT HOT SOAK
73370811000000	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 2	NON-CAT RUNNING EVAP
73371211000000	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 2	NON-CAT HOT SOAK
73373611000000	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 2	CAT RUNNING EVAP
73374011000000	ON-ROAD VEHICLES	LT.HVY.DTY TRUCKS- 2	CAT HOT SOAK
73470811000000	ON-ROAD VEHICLES	MED. HVY. DTY TRUCKS	NON-CAT RUNNING EVAP
73471211000000	ON-ROAD VEHICLES	MED. HVY. DTY TRUCKS	NON-CAT HOT SOAK
73473611000000	ON-ROAD VEHICLES	MED. HVY. DTY TRUCKS	CAT RUNNING EVAP
73474011000000	ON-ROAD VEHICLES	MED. HVY. DTY TRUCKS	CAT HOT SOAK
73670811000000	ON-ROAD VEHICLES	HVY. HVY. DTY TRUCKS	NON-CAT RUNNING EVAP
73671211000000	ON-ROAD VEHICLES	HVY. HVY. DTY TRUCKS	NON-CAT HOT SOAK
73673611000000	ON-ROAD VEHICLES	HVY. HVY. DTY TRUCKS	CAT RUNNING EVAP
73674011000000	ON-ROAD VEHICLES	HVY. HVY. DTY TRUCKS	CAT HOT SOAK
75070811000000	ON-ROAD VEHICLES	MOTORCYCLES	RUNNING EVAP RUNNING LOSSES
75071211000000	ON-ROAD VEHICLES	MOTORCYCLES	HOT SOAK
75073611000000	ON-ROAD VEHICLES	MOTORCYCLES (MCY)	CAT RUNNING EVAP
75074011000000	ON-ROAD VEHICLES	MOTORCYCLES (MCY)	CAT HOT SOAK
76270811000000	ON-ROAD VEHICLES	HVY. GAS URBAN BUSES	NON-CAT RUNNING EVAP
76271211000000	ON-ROAD VEHICLES	HVY. GAS URBAN BUSES	NON-CAT HOT SOAK
76273611000000	ON-ROAD VEHICLES	HVY. GAS URBAN BUSES	CAT RUNNING EVAP
76274011000000	ON-ROAD VEHICLES	HVY. GAS URBAN BUSES	CAT HOT SOAK
77070811000000	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	NON-CAT RUNNING EVAP
77071211000000	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	NON-CAT HOT SOAK
77073611000000	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	CAT RUNNING EVAP
77074011000000	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	CAT HOT SOAK
77170811000000	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	NON-CAT RUNNING EVAP
77171211000000	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	NON-CAT HOT SOAK
77173611000000	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	CAT RUNNING EVAP
77174011000000	ON-ROAD VEHICLES	SCHOOL BUSES (SB)	CAT HOT SOAK
77670811000000	ON-ROAD VEHICLES	OTHER BUSES (OB)	NON-CAT RUNNING EVAP
77671211000000	ON-ROAD VEHICLES	OTHER BUSES (OB)	NON-CAT HOT SOAK
77673611000000	ON-ROAD VEHICLES	OTHER BUSES (OB)	CAT RUNNING EVAP
77674011000000	ON-ROAD VEHICLES	OTHER BUSES (OB)	CAT HOT SOAK
77770811000000	ON-ROAD VEHICLES	OTHER BUSES (OB)	NON-CAT RUNNING EVAP
77771211000000	ON-ROAD VEHICLES	OTHER BUSES (OB)	NON-CAT HOT SOAK
77773611000000	ON-ROAD VEHICLES	OTHER BUSES (OB)	CAT RUNNING EVAP
77774011000000	ON-ROAD VEHICLES	OTHER BUSES (OB)	CAT HOT SOAK
78070811000000	ON-ROAD VEHICLES	MOTOR HOMES (MH)	NON-CAT RUNNING EVAP
78071211000000	ON-ROAD VEHICLES	MOTOR HOMES (MH)	NON-CAT HOT SOAK
78073611000000	ON-ROAD VEHICLES	MOTOR HOMES (MH)	CAT RUNNING EVAP
78074011000000	ON-ROAD VEHICLES	MOTOR HOMES (MH)	CAT HOT SOAK
89089511000041	GASOLINE CANS	GASOLINE (UNSPECIFIED)	FOUR-STROKE RUNNING EVAP